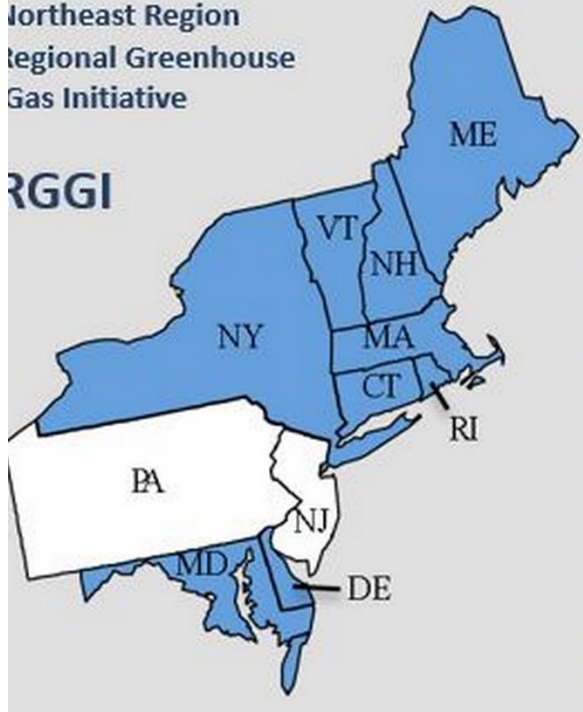




Northeast Region  
Regional Greenhouse  
Gas Initiative

RRGGI



New Hampshire  
Local Energy  
Work Group



# ENERGY CHAPTER

## 2015 REGIONAL MASTER PLAN

For the Rockingham Planning Commission Region



# Energy

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*Cover photo credits: Electric vehicle charging station, Portsmouth Patch (top right); SEAREI PV installation project, searei.org (bottom right).*

# Energy

## Introduction

### The Complex Energy Picture

Our region and New Hampshire's response to energy, climate change, and our economic future are inextricably linked. As a result of this interaction, energy consumption and climate change share common ground with respect to the actions that can address not only their impacts but their benefits and possible opportunities. The most effective actions include energy efficiency and conservation, which reduce the amount of energy consumed, while renewable energy eliminates emissions and shifts the source of the energy to local and domestic sources. Locally produced energy creates jobs and keeps dollars in the state economy.

All citizens in New Hampshire depend on reliable energy to carry out their work and conduct their lives. As a result of this need, 10 to 50 percent of the income of many New Hampshire households goes to paying energy bills, and energy is a significant expense for businesses, industries, and government. (Vermont Energy Investment Corporation, 2011) As energy costs rise, the region can strengthen its economy and preserve the environment by focusing on energy conservation and efficiency, making the best use of our region's renewable resources, and implementing sustainable land use and resource conservation practices.

While expanded energy efficiency will reduce total energy demand and emissions, further emission reductions can be achieved as New Hampshire meets an increasing portion of its total energy demand by developing renewable and low- CO<sup>2</sup> emitting energy resources.

*NH Climate Action Plan (2009)*

In order to preserve our quality of life, it is important to understand and plan for our future energy use, recognizing that rising energy costs influence municipal budgets and local and regional economies. Dependence on energy sourced from outside the state affects our energy security. Use of carbon based energy sources can adversely influence climate, air quality, water quality, ecosystems, and public health. New Hampshire as a state is heavily dependent on the use of petroleum, coal, natural gas, and nuclear energy to generate electricity, heat our homes and businesses, and fuel our vehicles. Much of this energy is imported from outside our state. According to the New Hampshire Office of Energy and Planning, 89 percent of our gross energy inputs came from non-renewable sources. Because New Hampshire lacks fossil fuel and nuclear material resources, most of the money to purchase energy leaves the state and the country.

Statewide climate change mitigation efforts (greenhouse gas reductions) are focused on the sources of energy we use, how we produce energy, how much energy we use and for what purpose. Future economic growth in New Hampshire – paired with climate change mitigation and adaptation actions - will depend on how quickly we transition to a far more diversified energy portfolio, more efficient use of energy and development of our communities in ways that strengthen neighborhoods and urban centers, preserve rural areas, and retain New Hampshire's quality of life.

Statewide planning efforts in climate change and energy serve as guides for all regions of the state to work toward a more resilient and secure energy future. The New Hampshire Climate Action Plan (2009) and State Energy Strategy (2014) contain recommendations that have the potential to guide collaborative efforts across the state toward common goals. These plans are described in more detail in the following sections.

### Municipal Energy Initiatives

Municipalities play an important role in the region's energy future by becoming themselves energy efficient, leading their community by example to conserve and make beneficial energy choices. Local energy production is also key to keeping energy dollars in the state, adding security in the supply of energy, and diversifying energy choices for residents, businesses and other consumers. In most cases, municipal zoning and land use regulations do not offer incentives to implement energy efficient site design and construction or renewable energy installations, although recent legislation has opened many opportunities for municipalities to adopt

such incentives. For example, 2013 legislation permits net metering whereby groups of buildings, even subdivisions, can share an energy source (typically renewable), selling back to the distribution grid any unused power generated by the facility. Net metering does not require changes to existing zoning and land use regulations.

Refer to the Enabling Statues section below for information about energy legislation.

In recent years, municipalities across the region have undertaken a wide range of energy related actions to better understand their energy expenditures and discuss long range energy planning. Examples include formation and technical support of energy committees, energy use inventories, building and facilities audits, master planning, infrastructure improvements, renewable energy installations, and community outreach. These efforts were largely supported by energy programs implemented by the N.H. Office of Energy and Planning and funded through federal grant programs, tax credits and rebates. Overall, municipalities benefited in many ways through their participation in these programs. Benefits ranged from gaining insight about dollars spent on energy each year, sharing experiences and challenges to meet community needs, learning about the value of preserving their historic facilities, and exchanging innovative practices.

Refer to the Energy Technical Assistance Partnership Program and Local Support of Renewable Energy sections for more information.

### **New Hampshire State Energy Strategy**

New Hampshire Senate Bill 191-FN-A established a state energy council for the purposes of developing a ten year energy strategy for the state. Released by the Office of Energy and Planning in September 2014, the New Hampshire State Energy Strategy (prepared by Navigant Consulting, Inc.) serves to provide “forward looking guidance on electric, gas and thermal energy strategies in order to optimize the use of readily available energy resources while minimizing negative impacts on the economy, the environment, and the natural beauty of the state.”

The Strategy was prepared using a phased approach which included:

- Development of a forecast for the projected consumption of electricity, natural gas and other fuels taking into consideration the existing infrastructure, expected retirements, and the possibility of alternative resources.
- Development an energy vision to guide strategy recommendations.
- Evaluation of the resource potential for energy efficiency, renewable energy, alternative fuels, distributed energy resources, demand response, storage, and transportation options across New Hampshire.
- Analysis of the existing policies, comparison to examples of best in class policy from other states, and synthesis of this data to provide strategy recommendations.
- 

The Strategy summarizes the results of the energy baseline, energy vision, resource potential study, and policy analysis. It addresses the barriers and gaps standing in the way of the vision and puts forth a series of policy recommendations and strategies to address them.

As shown in Figure EE1, the Strategy identifies as part of the Energy Vision key drivers (high impact, high influence) that will define New Hampshire’s energy future – energy efficiency, renewable power generation, fuel choice and availability, transportation options, and grid modernization.

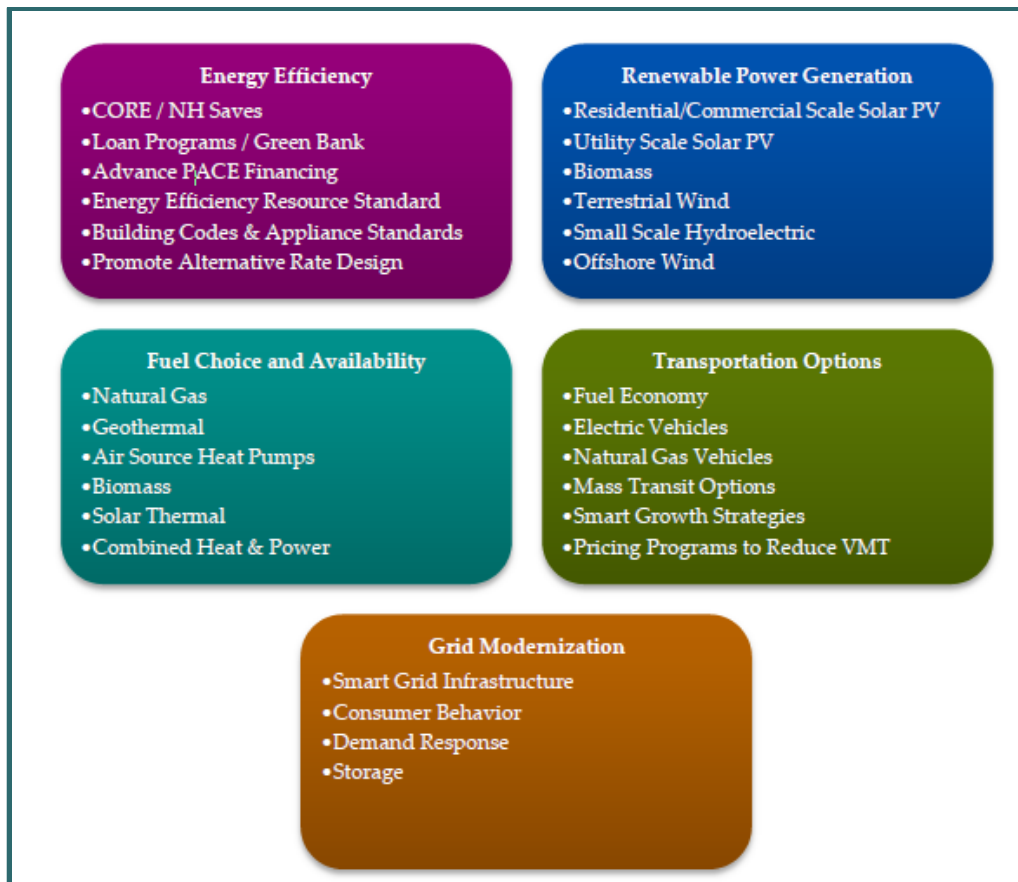


Figure EE1. Resources, programs and initiatives that influence the key drivers of the state's energy future.

## New Hampshire Climate Action Plan

In 2009, the Governor's Climate Change Policy Task Force released the N.H. Climate Action Plan, containing 67 overarching strategies necessary to meet the states greenhouse gas reduction, economic, environmental, and climate change related goals. The Plan's Task Force recommended that New Hampshire strive to achieve a long-term reduction in greenhouse gas emissions of 80 percent below 1990 levels by 2050. The recommended strategies are organized into the following 10 overarching plan goals:

1. Maximize energy efficiency in buildings.
2. Increase renewable and low CO<sub>2</sub>-emitting sources of energy in a long-term sustainable manner.
3. Support regional and national actions to reduce greenhouse gas emissions.
4. Reduce vehicle emissions through state actions.
5. Encourage appropriate land use patterns that reduce vehicle-miles traveled. Reduce vehicle-miles traveled through an integrated multi-modal transportation system.
6. Protect natural resources (land, water and wildlife) to maintain the amount of carbon fixed or sequestered.
7. Lead by example in government operations.
8. Plan for how to address existing and potential climate change impacts.
9. Develop an integrated education, outreach and workforce training program.

The Plan aims to achieve the greatest feasible reductions in greenhouse gas emissions while also providing the greatest possible long-term economic benefits to the citizens of New Hampshire. The most significant reductions in both emissions and costs will come from substantially increasing energy efficiency in all sectors of our economy, continuing to increase sources of renewable energy, and designing our communities to reduce our reliance on automobiles for transportation.

New Hampshire's Climate Action Plan presents an opportunity to:

- Spur economic growth through investment in our state's economy of monies currently spent on energy imports.
- Create jobs and economic growth through development of in-state sources of energy from renewable and low-emitting resources, and green technology development and deployment by New Hampshire businesses.
- Avoid the significant costs to the state's infrastructure, economy, and the health of our citizens needed to respond to climate change.
- Preserve the unique quality of life that makes New Hampshire an outstanding place to live, work, and raise a family.

The plan was intended to act as a broad guide to examine - across a broad spectrum of sectors - projected future conditions and needs, and adjust our actions as needed to maintain a high quality of life in our state. The N.H. Climate Action Plan has helped guide many research and planning initiatives, policy decisions, and audits of the existing regulatory standards and procedures by state agencies to address climate change. Currently, there is no dedicated funding source or staff to assist with implementing the recommendations of the plan.

## Enabling Statutes

New Hampshire statutes establish the purpose for implementation and the authority given to municipalities to pursue planning initiatives and adopt land use regulations relating to energy. As described below, legislative actions have enabled greater flexibility and choices, provided incentives, and removed barriers for municipalities and private citizens to pursue energy alternatives.

**State Economic Growth, Resource Protection, And Planning Policy RSA 9-B:3 (enacted in 2000):**

Defines smart growth as "the control of haphazard and unplanned development and the use of land which results over time, in the inflation of the amount of land used per unit of human development, and of the degree of dispersal between such land areas. The statute permits the results of smart growth to address land use, environmental protection and quality of life elements.

**Energy Commissions RSA 38-D (effective September 27, 2009):** Enables the appointment of an energy commission by either the local legislative or the local governing body of 3-10 members with staggered three year terms. The purpose of an energy commission is "...for the study, planning, and utilization of energy resources for municipal buildings and built resources of such city or town", to research municipal energy use, and recommend to local boards pertaining to municipal energy plans and sustainable practices, such as energy conservation, energy efficiency, energy generation, and zoning practices.

**Persons and Property Liable to Taxation RSA 72:61-72:73:** Permits municipalities to offer a property tax exemption on solar, wind and wood heating energy systems. These systems include solar hot water, solar photovoltaic, wind turbine or central wood heating systems (not stovetop or woodstoves).

**State Building Code RSA 155-A:2(VI):** Permits communities to adopt stricter measures than the New Hampshire State Building Code.

**Net Energy Metering RSA 362-A:9 (enacted in 2013):** Permits net metering in conformance with net metering rules adopted and orders issued by the Public Utilities Commission.

**Master Plan; Purpose and Description RSA 672:1 III-a:** "Proper regulations encourage energy efficient patterns of development, the use of solar energy, including adequate access to direct sunlight for solar energy uses, and the use of other renewables forms of energy, and energy conservation. Therefore, zoning ordinances should not unreasonably limit installation of solar, wind, or other renewable energy systems or the building of structures that facilitate the collection of renewable energy, except where necessary to protect the public health, safety, and welfare."

**Planning and Zoning, Master Plan, Purpose and Description RSA 674:2.III(n):** "An energy section, which includes an analysis of energy and fuel resources, needs, scarcities, costs, and problems affecting the municipality and a statement of policy on the conservation of energy."

## What the Region Said About Energy

### Statewide and Regional Surveys

#### Statewide Survey Results

Three of four residents (77%) support expanding incentives for home energy efficiency improvements (with 52% who “strongly support”), followed by higher energy efficiency standards in new buildings (74%), and promoting renewable energy sources such as solar, wind and geothermal (73%). Meanwhile only 34% were in support of public charging stations for electric vehicles.

- Those who work at home are *more* likely to strongly support expanding incentives for home energy efficient improvements.
- Households earning less than \$40,000 are *more* likely to strongly support promoting renewable energy sources.

Half of residents (49%) think that local governments should be very involved in guidelines for renewable energy (such as large wind farms), 38% think they should be somewhat involved, 6% think they shouldn’t be very involved, 6% think they should be not at all involved and 1% don’t know.

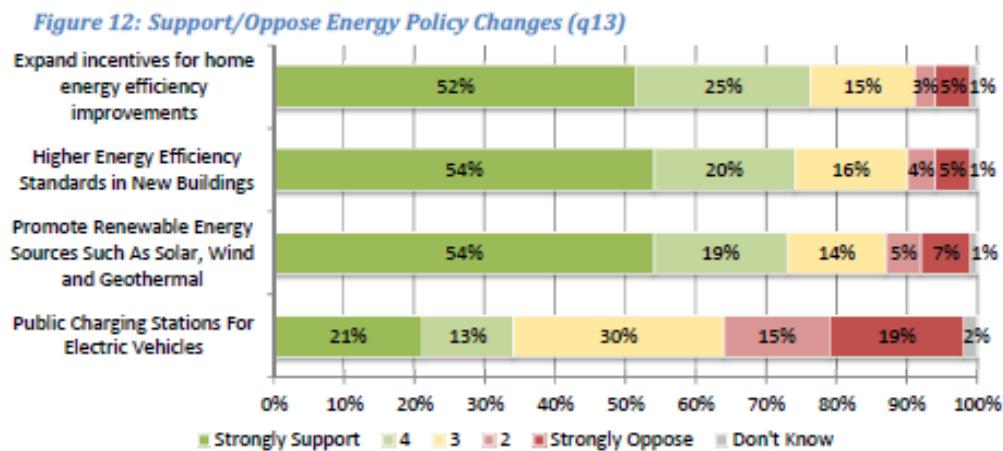


Figure EE2. Public input about changes in state and local energy policy.

**Survey Question:** We are seeing more proposals for (local) renewable energy projects such as large wind farms. How involved do you feel local communities should be in developing guidelines and standards for such renewable energy facilities?

Answer Options	Response Percent	Response Count
Very involved	52.3%	114
Somewhat involved	33.5%	73
Not very involved	7.3%	16
Not at all involved	6.9%	15
<b>answered question</b>		<b>218</b>
<b>skipped question</b>		<b>42</b>

Figure EE3. Public input about implementation of renewable energy project and level of local involvement.



**Survey Question:** Which of the following issues facing New Hampshire communities do you think should be the TOP priority for investment of public dollars? Select Top priority.

Answer Options	Response Percent	Response Count
Safe and Affordable housing choices	12.6%	26
Transportation system	12.1%	25
Energy efficiency	8.7%	18
Environmental Protection/Natural Resources Conservation	23.2%	48
Economic Development	17.9%	37
Infrastructure for development	12.6%	26
Preparedness for weather-related and other emergencies	13.0%	27
Other (please specify):		12
<b>answered question</b>		<b>207</b>
<b>skipped question</b>		<b>53</b>

Figure EE4. Public input about investment of public dollars in energy related issues.

## Regional Visioning Sessions Summary

### Question – Do you have energy choices?

#### Comments/Observations

- Propane, oil and electric. Natural gas only in new developments (cost of running new lines)
- Electricity price is stable. Most people not changing due to low cost of electricity
- Propane is cheap, reasonable. Wood to supplement but product options needed
- Solar pay back is too long. Economic benefit to solar or other alternative energy isn't viable; solar is costly for most. Incentive/leasing option can cause solar to be a more affordable option
- Most money spent on heat, smaller amount spent on cooling. Both costs reduced with conservation measures.
- Municipal collaborative groups (Plaistow Area Commerce Exchange) are effective at the local level; Use renewable energy LEAN program to help people buy/install renewable energy
- Portable generators use widely but noisy and stinky (pollute)
- Transportation costs high to get to work as jobs aren't where people live.
- Health/heat impacts to vulnerable populations
- Local actions can make impact (e.g. energy Committees, conservation, energy options, reduce use)

#### Actions Supported

- Establish a statewide energy policy including state and municipal level interactions
- Need more/better public transportation options. Improve bike transport.
- Incentives for energy efficiency conservation to reduce vehicle miles of travel, reduce consumption
- New developments incorporate walkable neighborhoods, reduce energy use
- Need more energy efficient buildings
- Need more regional cooperation on energy issues (i.e. RGGI-Regional Greenhouse Gas Initiative)
- For alternative sources (geothermal, wind and solar) efforts needed to expand individual use (could benefit real estate values). Renewable energy desirable but 'not in my back yard'.
- More use of tax incentives for alternative energy uses
- Increase use of alternative energy by municipalities and institutions (schools)
- State should increase support of public transportation

## Energy Goals

### Goal 1

State plans and regional initiatives focus energy planning and implementation toward local energy sources and supplies.

### Goal 2

Federal and state standards, programs and initiatives reduce greenhouse gas emissions.

### Goal 3

Municipalities lead their communities by example in becoming energy efficient in their policies, operations and facilities management.

### Goal 4

More energy is produced from renewable energy sources.

### Goal 5

Consumer choices across all sectors increase energy efficiency and conservation and use of renewable energy sources.

### Goal 6

Impacts of climate change are mitigated through improved energy policies and standards.

### Goal 7

Energy strategies capitalize on positive benefits and opportunities created by changes in climate.

	<b>Regional Goal Promote the efficient use of land, resources and infrastructure that:</b>				
	Creates a high quality built environment while protecting important natural and cultural resources.	Promotes positive effects of development and minimizes adverse impacts.	Promotes economic opportunities and community vitality.	Enhances the coordination of planning between land use, transportation, housing and natural resources.	Considers and incorporates climate change into local and regional planning efforts
<b>Energy Goals</b>					
<b>EN Goal 1</b>	S	P	S	P	S
<b>EN Goal 2</b>	S	S	S	S	S
<b>EN Goal 3</b>	P	S	S	P	S
<b>EN Goal 4</b>	S	S	S	S	S
<b>EN Goal 5</b>	S	S	S	P	S
<b>EN Goal 6</b>	S	S	S	S	S
<b>EN Goal 7</b>	S	P	S	S	S
<p>S = Goal supports the Regional Goal.                      P = Goal partially supports the Regional Goal.                      TBD = Goal applicability to support the Regional Goal is not yet known.                      N/A = Goal does not apply to the Regional Goal.</p>					

	<b>N.H. Livability Principles</b>					
	Traditional Settlement Patterns & Development Design	Housing Choices	Transportation Choices	Natural Resources Function & Quality	Community & Economic Vitality	Climate Change & Energy Efficiency
<b>Energy Goals</b>						
<b>EN Goal 1</b>	P	TBD	S	P	S	S
<b>EN Goal 2</b>	S	TBD	S	S	S	S
<b>EN Goal 3</b>	P	TBD	S	S	S	S
<b>EN Goal 4</b>	P	TBD	S	S	S	S
<b>EN Goal 5</b>	P	P	S	S	S	S
<b>EN Goal 6</b>	P	TBD	S	S	S	S
<b>EN Goal 7</b>	P	P	S	S	S	S

S = Goal supports the N.H. Livability Principle.  
P = Goal partially supports the N.H. Livability Principle.  
TBD = Goal applicability to support the N.H. Livability Principle is not yet known.  
N/A = Goal does not apply to the N.H. Livability Principle

## Existing Conditions

### Energy Utilities

Southeast New Hampshire is served by several electric utilities – Unitil, Eversource (formerly PSNH) New Hampshire Electric Cooperative, Inc., and Granite State Electric. Unitil also provides natural gas to a portion of its service area. Refer to the map below for the electric utility service areas and to the Appendix B Map EE1 for location of electric and gas distribution lines in the region.

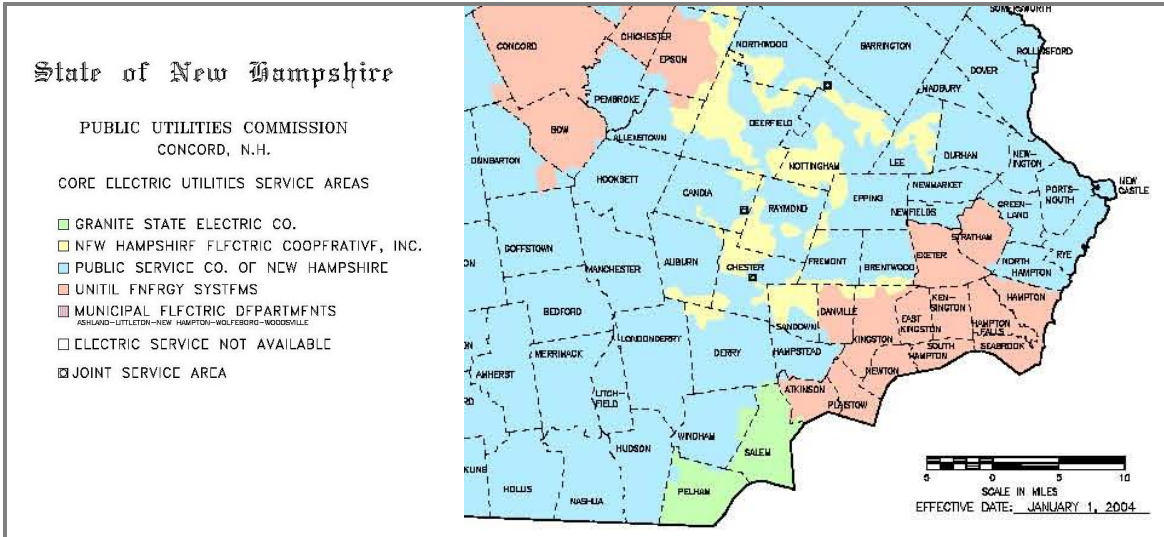


Figure EE5. Map of electric utility service areas in the region.

Each utility offers a variety of residential, business and municipal energy efficiency, purchasing and rebate programs focused on retrofits, replacement systems and new construction. New Hampshire's regulated electric distribution utilities jointly develop and offer their customer's energy efficiency programs under a statewide umbrella program, NH Saves. These programs are funded via a charge included in customer rates. Each year, the New Hampshire Public Utilities Commission reviews and approves program plans and budgets submitted by the utilities. Utilities can earn performance incentives based on successful implementation of their programs and meeting performance goals.

Recently additional funding for New Hampshire's "core" customer energy efficiency programs is provided via the "Regional Greenhouse Gas Initiative" (RGGI). The legislation governing RGGI requires that the first dollar from the sale of greenhouse gas allowances is to go to fund electric energy efficiency programs. Refer to the section Statewide Initiatives and Programs for more details about RGGI.

Natural gas efficiency programs are not part of NH Saves. New Hampshire natural gas utilities administer energy efficiency programs that are approved by the New Hampshire Public Utilities Commission.

### Energy Production, Terminal and Storage Facilities

The region has six energy production facilities and four energy terminal and storage facilities. The energy production facilities are owned primarily by utilities and one manufacturing business.

The energy terminal and storage/distribution facilities, primarily import fossil fuels (oil, coal, coke, propane and jet fuel) and sell these materials wholesale where they are distributed by transport truck, tanker truck and rail to retail buyers. These facilities are located in Portsmouth and Newington along the Piscataqua River, the only deep water port in New Hampshire.

Refer to Appendix A for a map of the energy production, terminal and storage facilities in the region.

*Table EE1. Energy Production, Terminal and Storage Facilities in the Region*

<b>Energy Production Facilities</b>					
<b>Plant Name</b>	<b>Plant Code</b>	<b>Utility Name</b>	<b>Utility ID</b>	<b>Total Net Summer Capacity</b>	<b>Net Summer Capacity by Energy Source</b>
Seabrook	6115	NextEra Energy Seabrook LLC	6854	1,246.2 MW	Nuclear = 1246.2 MW
Schiller	2367	Public Service Co of NH	15472	155.5 MW	Coal = 95.4 MW Petroleum = 17 MW Wood = 43.1 MW
Newington	8002	Public Service Co of NH	15472	400.2 MW	Petroleum = 400.2 MW
EP Newington Energy LLC	55661	EP Newington Energy LLC	13538	525 MW	Natural Gas = 525 MW
Hampton Facility	10108	Foss Manufacturing Company LLC	6636	7.6 MW	Natural Gas = 3.8 MW Petroleum = 3.8 MW
<b>Energy Terminals and Storage Facilities</b>					
<b>Company Name</b>			<b>Site Name</b>	<b>Products</b>	
Sprague Operating Resources LLC			Avery Lane and River Road	Petroleum and coal imports	
Irving Oil Terminals Inc.			Portsmouth Marine	Petroleum imports	
SEA 3 Inc.			Newington	Liquefied petroleum imports	
Port of Portsmouth, New Hampshire			Port ID: 135	Handles 200 or more short tons per year in total volume (import and export) of petroleum products	

Refer to Appendix A Map EE1 for distribution of energy facilities and infrastructure in seacoast New Hampshire.

## Energy Sources and Use

New Hampshire sources nearly 90 percent of its energy from out of state as it has no in-state sources of fossil fuels or nuclear material. The graph below shows the types of energy used and their relative percent of consumption. Petroleum and nuclear power alone comprise 55 percent of the state’s total energy portfolio.

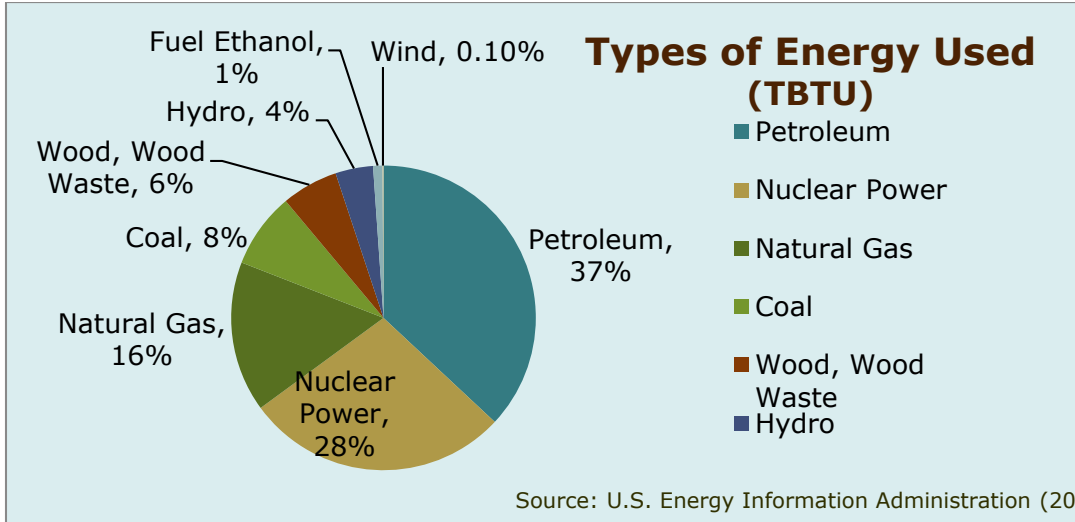


Figure EE6. Types and relative percentage of fuels consumed in New Hampshire. TBTU means "trillion British Thermal Units"; British Thermal Units is a standardized measure of energy produced by any energy or fuel source.

Of the electricity produced in-state, 79 percent is derived from nuclear power and natural gas, with lesser use of renewable sources, hydroelectric, coal and petroleum sources. Total energy production in the state is derived from 89 percent non-renewable and 11 percent renewable sources. The N.H. Climate Action Plan recommends increasing renewable and low-CO2-emitting sources of energy in a long-term sustainable manner.

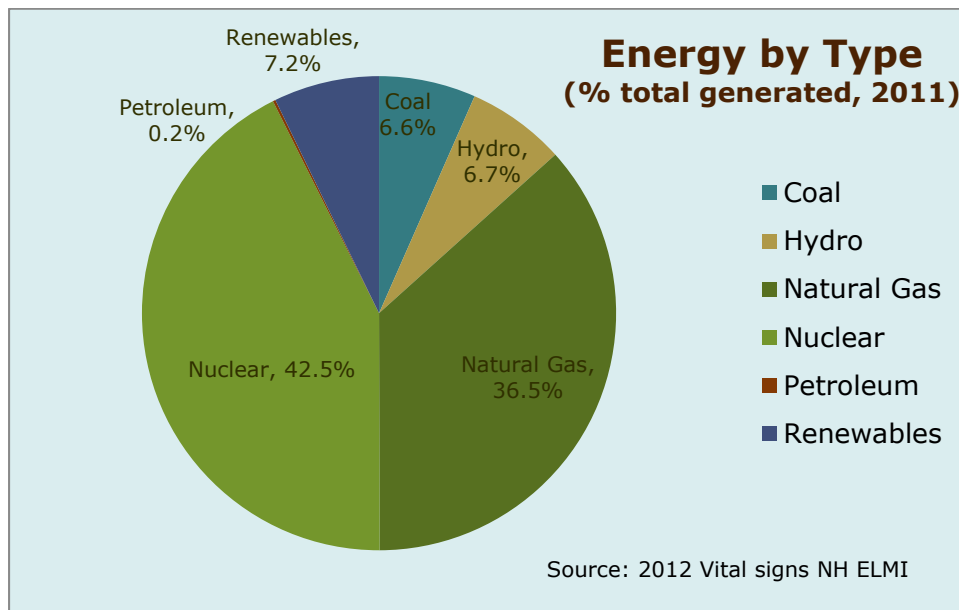


Figure EE7. Types and relative percentage of energy produced in New Hampshire.

New Hampshire consumes the most amount of energy in four areas: the transportation, residential, commercial and industrial sectors. Residential and commercial development combined account for 52.5 percent of energy consumption in the state.

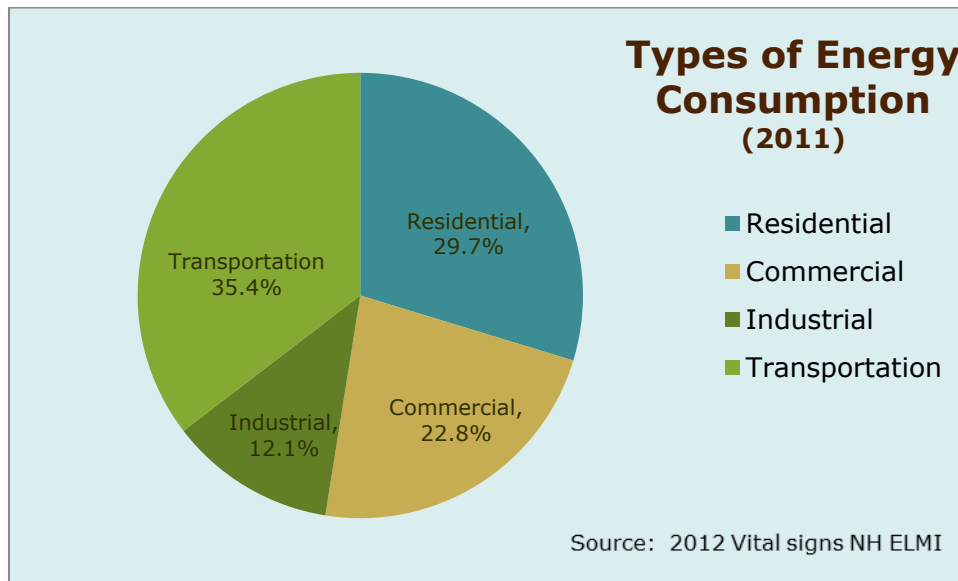


Figure EE8. Energy consumption in New Hampshire by type of use.

The N.H. Climate Action Plan recommends the following to reduce consumption of fossil-based fuels through increased efficiency and emissions reductions: maximize energy efficiency in buildings; support regional and national actions to reduce greenhouse gas emissions; reduce vehicle emissions through state actions; and encourage appropriate land use patterns that reduce vehicle-miles traveled through an integrated multi-modal transportation system.

### Energy Consumption and Population Growth

Over the past 20 years, it is clear that total energy use has risen, primarily within the transportation and electric generation sectors.

When total energy consumption is analyzed per capita (comparison to the state’s population), energy consumption or intensity of use in 2010 was very similar to 1960’s levels of just over 200 Million Btu’s. Consumption per capita in the preceding decades reached the highest levels during the 1960 to 2010 time period, exceeding 250 million Btu’s.

This may be due to improvements in technology and efficiency as well as a shift in New Hampshire’s economy as industrial activity has declined.

#### Total Energy Consumption for New Hampshire Per Capita

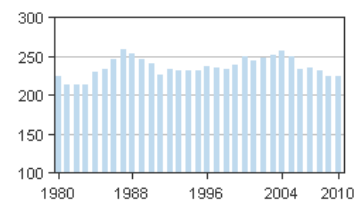
One measure of the energy intensity of the New Hampshire economy deals with the gross measure of total energy consumed divided by the state population. This per capita indicator is a good measure of energy consumption because decisions by individual consumers have an important effect on overall energy consumption.

Source: U.S. Energy Information Administration (EIA) State Energy Data System (SEDS database).

New Hampshire per capita energy consumption in 2011 (million Btu)	222
U.S. per capita energy consumption (million Btu)	368
State rank for per capita energy consumption	43

#### Total Energy Consumption per Capita 1980 - 2011

(million Btu)



Compare with other states.

Figure EE9. Energy consumption compared with population growth.



## Vehicle Miles of Travel (VMT)

From the 1970's until the mid-2000s, the annual amount of vehicle miles of travel (VMT) per person in the United States grew steadily at an average rate of about 1.8% per year (FHWA, 2014), exceeding the average annual growth in population over the same time period of 1% per year (US Census Bureau, 2014). Beginning in 2004 this changed as the per capita VMT peaked and began to decline. This trend is reflected in the New Hampshire data as well with consistently declining per capita VMT since 2007 and current levels are below those seen in 2004. This trend has important implications for redirecting future investment in the transportation network towards preservation of the existing system and expansion of access to pedestrian, bicycle, and transit. Current efforts are focused on expanding capacity to reduce congestion. There are three main reasons generally attributed to this change (Davis, 2012):

- Fuel prices continue to remain high which impacts those with fixed or low incomes and businesses reliant on the mass transport of goods.
- Youth, as a group, are choosing more cost effective ways to travel. People under 35 are making choices of where to live and how to transport themselves in a period of high fuel and auto ownership costs and so are choosing to live in urban areas where car ownership is not necessary and transit, bikes, and walking are viable alternatives.
- Technology is replacing the need for some trips. Work from home, home based businesses, mobile communications technology and internet access have allowed many trips to be eliminated. Improved access to information on transit schedules and timing, and ride sharing opportunities is also shifting individual choices of how to travel.

The current decreasing trend in VMT is in part responsible for statewide reductions in greenhouse gas emissions. In 2011, the weighted average combined fuel economy of cars and light trucks combined was 21.4 miles per gallon (FHWA 2013). The average vehicle miles traveled in 2011 was 11,318 miles per year. Based on these figures, the annual greenhouse gas emissions per passenger vehicle is roughly 4.75 metric tons CO<sup>2</sup> per vehicle per year. (EPA, <http://www.epa.gov/cleanenergy/energy-resources/refs.html>)

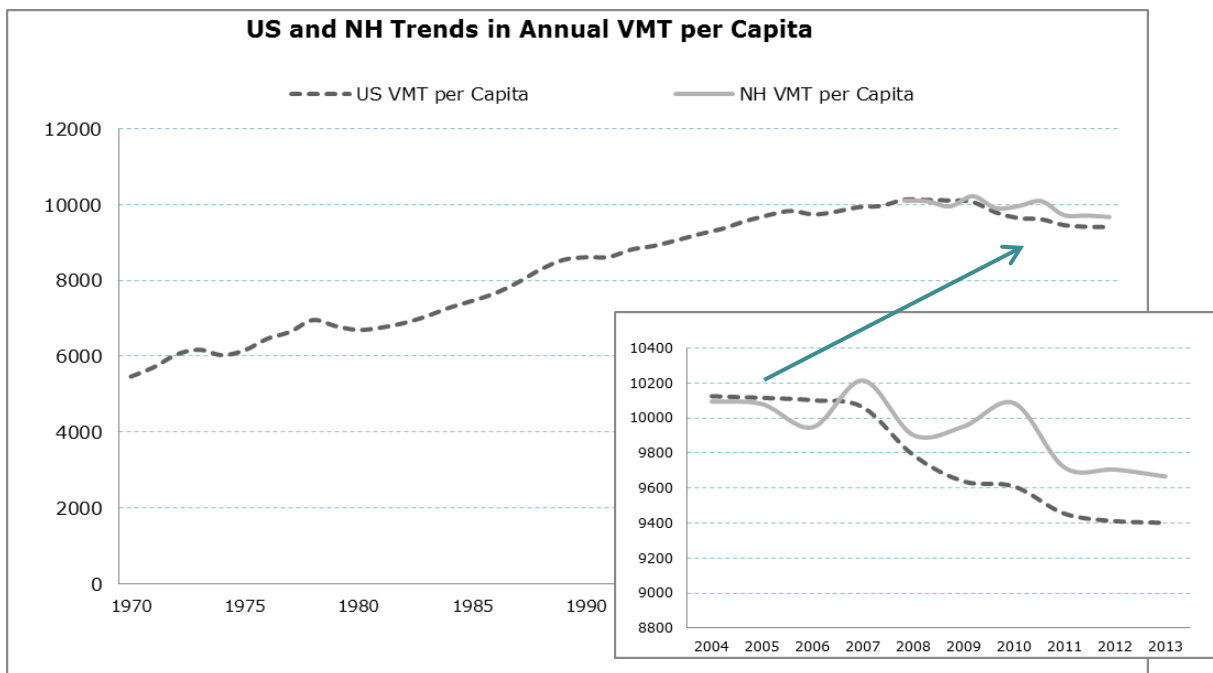


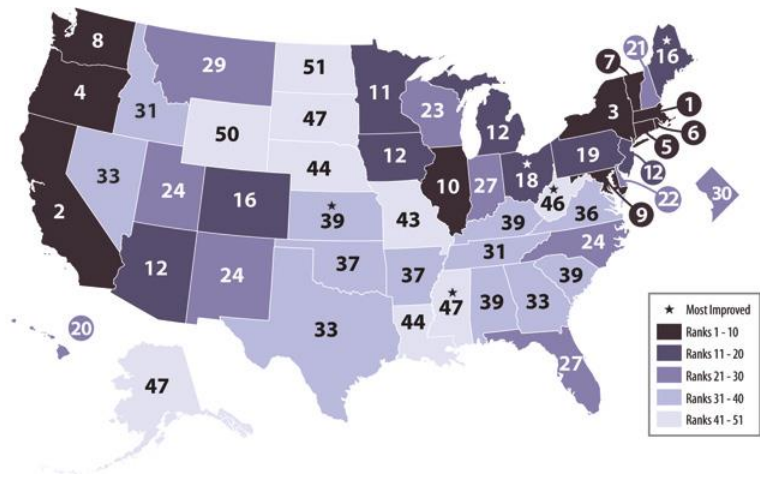
Figure EE10. U.S. and N.H. Per Capita Vehicle Miles of Travel.

## Efficiency

The American Council for an Energy Efficient Economy ranks New Hampshire 21st nationally in energy efficiency, behind all other New England states as well as most other Northeast and Mid-Atlantic States.

As reported in the New Hampshire State Energy Strategy (draft, 2014), the lack of a clear statewide goal for energy efficiency savings in is one of the factors affecting the state's national efficiency ranking.

Figure EE11. ACEEE energy efficiency rankings by state. [Source: American Council for an Energy Efficient Economy, State Policy]



### New Hampshire Public Utilities Commission

New Hampshire restructured its electric utility markets and has maintained support for its utility energy efficiency programs. In Order No. 23,574, issued November 2000, the New Hampshire Public Utilities Commission (PUC) emphasized its commitment to energy efficiency programs that complement new energy markets and do not hinder their development. The Commission requested that utilities work together to design a set of "core" programs that are consistent in their design and meet the Legislature's directive to target cost-effective opportunities that may otherwise be lost due to market barriers.

On May 31, 2002, the Commission issued an order approving the implementation of "core" energy efficiency programs by the state's electric utilities. This order established the basis for the NH Saves statewide energy efficiency program. The PUC reviews and authorizes the utilities' joint program plans and budgets annually. The utilities offer joint, statewide programs to gain the benefits of uniform planning, delivery, and evaluation. Within the umbrella of a statewide program, however, each individual utility incorporates flexibility in its implementation strategies and program delivery. The statewide program, NH Saves, uses shared marketing and information materials. (American Council for an Energy Efficient Economy) Refer to the Statewide Initiatives and Programs for more information about NH Saves.

## Greenhouse Gas Emissions (GHG)

Greenhouse Gas Emissions (GHG) and the build-up of carbon dioxide in our atmosphere cause changes to our state and worldwide climate. GHG emissions are a signature of the types of energy used and how much. Use of fossil based fuels (for heating/cooling, transportation and production), reduction of carbon storage areas, and energy inefficient of vehicles, infrastructure and appliances are the primary contributors of GHG emissions.

New Hampshire ranks in the upper range of per capita CO<sub>2</sub> emissions compared with other New England states. From 1990 to 2002, New Hampshire emitted roughly 14-15.5 million metric tons of CO<sub>2</sub> per capita annually. From 2003 to 2005, emissions increased to a low of 16.3 and a high of 17.9 million metric tons of CO<sub>2</sub> per capita annually, followed by a steady decline through 2009 to a low of 13.4 million metric tons of CO<sub>2</sub> per capita annually.

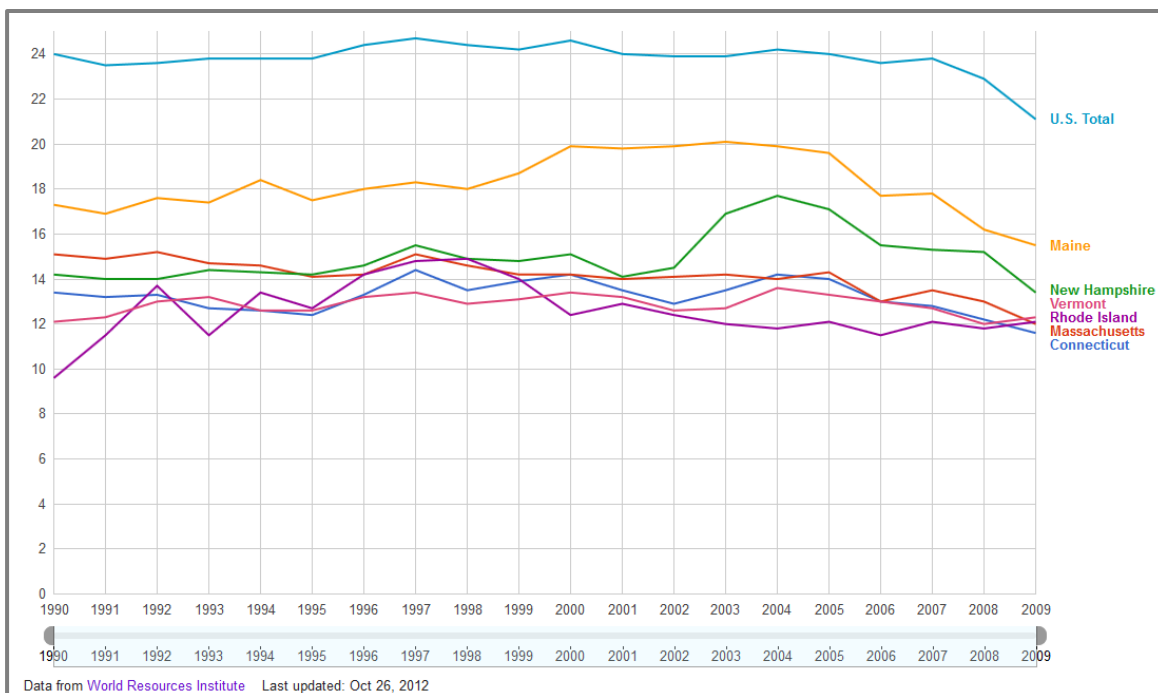


Figure EE12. Total CO2 emissions per capita for New England States measured in million metric tons.

The New Hampshire Climate Action Plan recommends that New Hampshire strive to achieve a long-term reduction in greenhouse gas emissions of 80 percent below 1990 levels by 2050. The goal of reducing greenhouse gas emissions 80 percent below 1990 levels by 2050 has been adopted by numerous states, cities and organizations based on the reductions that climate scientists believe to be necessary to stabilize greenhouse gases in the atmosphere at or below 450 parts per million CO<sup>2</sup>. Experts project that stabilizing concentrations of greenhouse gases at this level will avoid the most severe and catastrophic potential climate change impacts including sea level rise, drought and ecosystems.

In 2013, NOAA reported global atmospheric concentrations of CO<sup>2</sup> reached a daily average above 400 parts per million. Historically, comparable CO<sup>2</sup> levels were present more than 10 million years ago, during the middle of the Miocene period when global temperatures were substantially warmer than today, and there was very little ice around anywhere on the planet.

### 2014 EPA Proposal for Guidelines to Cut Carbon Pollution

The U.S. Environmental Protection Agency (EPA) released the Clean Power Plan proposal, which for the first time cuts carbon pollution from existing power plants, the single largest source of carbon pollution in the United States. Power plants account for roughly one-third of all domestic greenhouse gas emissions in the United States. While there are limits in place for other atmospheric pollutants and particle pollution that power plants can emit, there are currently no national limits on carbon pollution levels. (EPA, 2014)

The Clean Power Plan proposes guidelines that build on trends already underway in states and the power sector to cut carbon pollution from existing power plants, making them more efficient and less polluting. The Plan strives to protect public health, move the country toward a cleaner environment and fight climate change while supplying consumers with reliable and affordable power.

The Clean Power Plan will be implemented through a state-federal partnership under which states identify compliance strategies using either current or new electricity production and pollution control policies to meet the goals of the proposed program. The proposal provides guidelines for states to develop plans to meet state-specific goals to reduce carbon pollution and gives them the flexibility to design a program that makes the most sense for their unique situation. States can choose the right mix of generation using diverse fuels,

energy efficiency and demand-side management to meet the goals and their own needs. It allows them to work alone to develop individual plans or to work together with other states to develop multi-state plans.

New Hampshire’s carbon reduction requirements under the Plan are summarized below and apply to the state’s one coal fired power plant, Schiller Station in Newington.

*Table EE2. EPA proposed reductions in carbon dioxide emissions from power plants in N.H.*

<b>Proposed State Goal</b> <b>(Adjusted MWh-Weighted Average Pounds of CO<sub>2</sub> per Net MWh from all Affected Fossil Fuel Fired EGUs)</b>				
<b>Criteria</b>	<b>Option 1</b>		<b>Option 2</b>	
	<b>Interim Goal (2020-2029)</b>	<b>Final Goal (2030 forward)</b>	<b>Interim Goal (2020-2029)</b>	<b>Final Goal (2030 forward)</b>
		546	486	598

*Note: EPA is proposing state-specific rate-based goals to guide states in the development of their plans. The agency is proposing one option (Option 1) for state-specific goals and requesting comment on a second set of state-specific goals and compliance period (Option 2).*

## **Energy Technical Assistance Partnership Program**

Energy Technical Assistance Partnership Program (ETAP) for New Hampshire Communities was a federally funded two year program designed to raise awareness of the benefits of energy efficiency planning, and provide the technical assistance to municipalities. ETAP was funded by the American Recovery and Reinvestment Act (ARRA) of 2009 through the Department of Energy and administered by the New Hampshire Office of Energy and Planning.

The Energy Technical Assistance and Planning for N.H. Communities (ETAP) was a two year program providing energy efficiency technical assistance free of charge and open to all municipalities in the region. ETAP’s goal was to advance energy efficiency and provide the tools communities need to monitor energy performance and plan for energy efficiency and conservation for the future. ETAP provided assistance and training on how to conduct municipal energy inventories and develop preliminary “roadmaps” for municipal energy planning. Over two years, ETAP also offered the following services:

- Assisted communities to track and understand energy consumption in municipal buildings and other facilities
- Provided a web-based tool to collect and analyze energy performance
- Worked with communities to identify and prioritize energy cost reduction opportunities
- Helped develop strategies for energy cost reduction and secure technical and financial resources needed to implement energy savings

For communities that had completed inventories and sought to implement projects, ETAP provided support services, including grant writing assistance, energy audits of municipal facilities, energy audits of zoning and regulations, energy master plan chapters, capital improvement plans for energy efficiency, and preparation of procurement and service documents for infrastructure upgrades and new installations.

RPC’s 2-year work plan reached nearly every municipality in the region and accomplished the following outcomes listed in the table below. RPC worked closely with approximately 16 municipalities on a wide variety of projects including municipal energy use inventories, building and facilities assessments, Energy Chapters for local Master Plans, and organizational and communications plans for local energy committees. For most municipalities, ETAP program activities were led by a local energy committee with support from municipal staff, elected officials, planning boards and conservation commissions.

Although the ETAP program has ended, the program provided technical tools, capacity building and organization of local energy committees all of which continue to benefit municipalities now and into the future.

*Table EE3. Energy Technical Assistance and Planning program activities lead by local energy committees with support from municipal staff, elected officials, planning boards and conservation commissions.*

<b>Year 2 Actions</b>	<b>Community</b>	<b>Year 2 Outcomes</b>
<b>Technical Assistance, Energy Assessments and Audits, Energy Inventories</b>	Hampton Falls	Master Plan Energy Chapter (adopted), Lincoln Ackerman Elementary School energy audit, Town Hall historic preservation assessment, technical assistance for Energy Committee
	Atkinson	Master Plan Energy Chapter (adopted), technical support to the Energy Committee
	East Kingston	Municipal energy inventory
	Fremont	Master Plan Energy Chapter (adopted), Municipal energy inventory, technical assistance for Energy Committee
	New Castle	Municipal energy inventory, Maude Trefethen Elementary School energy audit, Master Plan Energy Chapter (draft)
	Newton	Municipal energy inventory, energy database enrollment, building assessments
	Plaistow	Municipal energy inventory, energy database enrollment, building assessments
	Rye	Complete building assessments, develop Energy Chapter for Master Plan
	Sandown	Municipal energy inventory and building assessments, Master Plan Energy Chapter (adopted)
	Seabrook	Municipal energy inventory, energy database enrollment, building assessments
	Hampton	Library energy audit, Roadmap Towards a More Energy Efficient Hampton, analysis of landfill as a solar installation site, outreach and education materials
	Windham	Review of existing building assessments, energy database enrollment, master plan, public outreach and education
	Stratham	Finalize selection of vendor for OEP grant funded work, master plan, prioritization of projects for municipal buildings
	Exeter	Building assessments of Town Offices and Library, prioritization of improvement projects for municipal buildings, draft Master Plan Energy Chapter
Kensington	Building assessments, energy database enrollment, prioritization of projects for municipal buildings	
<b>Engagement and Enrollment</b>	Brentwood, East Kingston, Epping, Greenland, Hampstead, Newington, North Hampton, South Hampton	Engagement with the goal of completing a municipal inventory, enrolling in the energy database, and reviewing model master plan chapter
<b>General Outreach and Education</b>	Kingston, Newfields, Portsmouth, Salem	General outreach to Clean Air-Cool Planet MEAP* towns and other communities in the region
<b>Regional Energy Workshop</b>	All municipalities invited; 26 participants	Guest speakers highlighting innovative energy efficiency projects, renewable energy installations, outreach and planning.

MEAP = Municipal Energy Assistance Program administered by Clean Air-Cool Planet

## Statewide Initiatives and Programs

### U.S. Department of Agriculture (USDA)

In 2014 the U.S. Department of Agriculture, Rural Energy for American Program awarded five New Hampshire small businesses with \$163,568 in USDA grants to install 200 kilowatts of solar capacity. The new solar projects will help reduce energy costs for the businesses and are estimated to generate enough electricity to power the equivalent of 180 homes a year. These competitive grants cover up to 25 percent of a project's cost with matching funds of nearly \$500,000 from other sources. The three businesses in the region awarded grants are:

959 Boys (Portsmouth): \$26,270 will assist with the purchase and installation of a 28.28 kilowatt solar photovoltaic roof-mounted system offsetting the current electrical usage of three businesses by 99.64 percent.

Conner Bottling Works (Newfields): \$49,921 will assist with the purchase and installation of a 43.68 kilowatt solar photovoltaic roof- and ground-mounted system offsetting current electrical usage by 100 percent.

The Storage Barn (Newington): \$19,900 will assist with the purchase and installation of a 20.16 kilowatt solar photovoltaic roof-mounted system offsetting electrical usage by 100 percent.

### Energy Efficiency & Sustainable Energy Board (ESEE)

The Energy Efficiency & Sustainable Energy Board was established pursuant to RSA 125-O:5-a, effective October 1, 2008. It was created by the New Hampshire Legislature "to promote and coordinate energy efficiency, demand response, and sustainable energy programs in the state." And serves as a key advisory body to the Governor and State Legislature on energy matters. The ESEE Board is administratively attached to the Public Utilities Commission. N.H. Office of Energy and Planning serves as vice-chair of the ESEE Board.

In 2012, the ESEE Board released a report and recommendations calling for a comprehensive energy policy for New Hampshire and detailing the steps the state should take to implement policies and enhance programs that will contribute to economic development, increased resilience and security of energy supply, and a cleaner environment. A copy of the "Final Report on the Independent Energy Study" is available at <http://www.puc.nh.gov/eese.htm>. (Energy Efficiency & Sustainable Energy Board, 2012)

The Energy Efficiency and Sustainable Energy (ESEE) Board was charged with review of the independent energy policy study required by Senate Bill 323 (SB323, 2010 Session). The Independent Energy Study was conducted by the Vermont Energy Investment Corporation (VEIC) to provide a comprehensive review of energy policy options and opportunities related to energy efficiency and sustainable energy for the state. The report submitted to the N.H. Public Utilities Commission (PUC) and Legislature contained fourteen chapters and more than 300 recommendations. The overarching finding of the study and review is that energy efficiency and renewable energy technologies provide significant economic and environmental benefits to residents, business owners and investors in New Hampshire and appropriate policies need to be developed.

In its review, the ESEE Board identified several key themes reported below that informed many of the detailed recommendations of VEIC's Study and the ESEE Board's resulting assessment.

#### Need for a clear, coordinated and consistent policy and program landscape.

New Hampshire's current energy policy environment is fragmented and subject to frequent modifications. Consumers would benefit from a more comprehensive and consistent approach in state energy policy and energy program offerings, stability in program funding, and a single lead entity within state government to coordinate the implementation of policies and programs. Stable and predictable policies facilitate the ability of private businesses as well as individuals to plan for and invest in energy efficiency and sustainable energy.

#### Need for a market development and market transformation focus.

Energy programs should encourage high-functioning markets that provide consumers and businesses with more options and better choices to achieve long-term energy priorities of efficiency, sustainability, and lower costs. Programs should foster responsiveness to changes in the marketplace to ensure that investments encourage adoption of new technologies and optimize strategic use of public dollars.

Need for targeted resources.

The state has achieved significant positive results in energy efficiency and renewable energy with limited financial resources. However, financial constraints impact the ability of many initiatives to achieve the full potential energy savings. Careful and judicious increases in funding and staff support in specific program areas would provide significant added benefits to meet the needs of the state and its consumers.

The 2012 EESE Board report includes three recommendations that support N.H.'s Long Term Growth and Prosperity as a framework under which all New Hampshire energy programs and policies could be developed and aligned.

1. Clearly Articulate a Comprehensive Energy Policy
2. Develop and Establish an Energy Efficiency Resource Standard (EERS)
3. Maintain and Strengthen the Renewable Portfolio Standard (RPS)

**Regional Greenhouse Gas Initiative (RGGI)**

Regional Greenhouse Gas Initiative, Inc. (RGGI, Inc.) is a 501(c)(3) non-profit corporation created to support development and implementation of the Regional Greenhouse Gas Initiative (RGGI). (Regional Greenhouse Gas Initiative)

In the northeast, RGGI is a cooperative effort among nine states – Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New York, Rhode Island and Vermont – to reduce greenhouse gas emissions.

**RGGI Mission Statement**

RGGI, Inc.'s exclusive purpose is to provide administrative and technical services to support the development and implementation of each RGGI State's CO<sub>2</sub> Budget Trading Program.

RGGI, Inc.'s activities include:

- Development and maintenance of a system to report data from emissions sources subject to RGGI, and to track CO<sub>2</sub> allowances
- Implementation of a platform to auction CO<sub>2</sub> allowances
- Monitoring the market related to the auction and trading of CO<sub>2</sub> allowances
- Providing technical assistance to the participating states in reviewing applications for emissions offset projects
- Providing technical assistance to the participating states to evaluate proposed changes to the States' RGGI programs

**Progress and Benefits**

Released in February 2014, the *Regional Investment of RGGI CO<sub>2</sub> Allowance Proceeds, 2012* report estimates that investments of Regional Greenhouse Gas Initiative (RGGI) auction proceeds to date are projected to return more than \$2 billion in lifetime energy bill savings to more than 3 million participating households and more than 12,000 businesses in the region.

These investments are projected to offset the need for approximately 8.5 million megawatt hours (MWh) of electricity generation, save more than 37 million British Thermal Units (million BTU) of fossil fuels, and avoid the release of approximately 8 million short tons of carbon dioxide (CO<sub>2</sub>) pollution into the atmosphere over their lifetime.

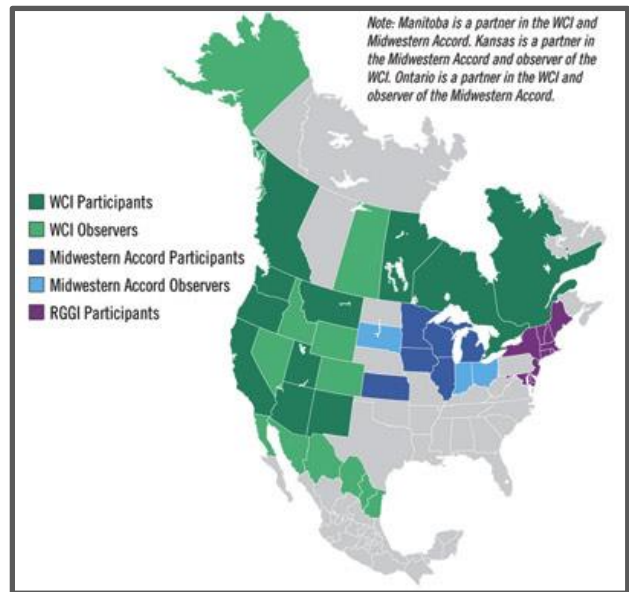
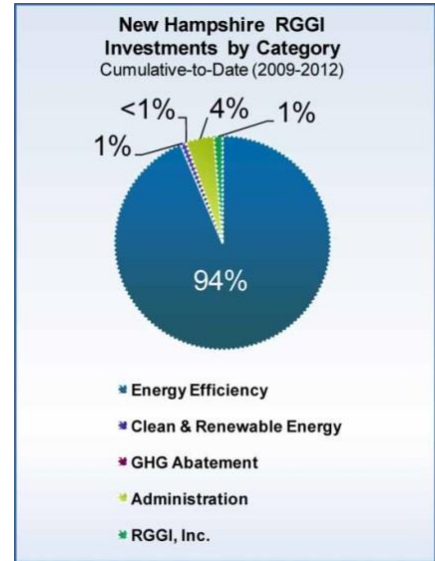


Figure EE13. Regional greenhouse gas initiatives and partnerships in the United States.

The program has powered a \$700 million investment in the region's energy future: reducing energy bills, helping businesses become more competitive, accelerating the development of local clean and renewable energy sources, and limiting the release of harmful pollutants into the air and atmosphere, while spurring the creation of jobs in the region.

***N.H. Regional Greenhouse Gas Initiative (RGGI)***

On June 23, 2012, New Hampshire enacted House Bill 1490, which revised the state's investment plan for its RGGI CO<sub>2</sub> allowance proceeds, effective January 1, 2013. Under the bill, New Hampshire's proceeds from the sale of RGGI CO<sub>2</sub> allowances will now supplement the electric distribution company CORE energy efficiency programs, funded by the System Benefits Charge (SBC) funds. Prior to this legislative change, New Hampshire directed more than 90 percent of its RGGI proceed clean energy investments to energy efficiency programs, such as the Stay Warm N.H. and the Greenhouse Gas Emissions Reduction Fund (GHGERF) managed by the New Hampshire Public Utilities Commission.



*Figure EE14. N.H. investments by category in Regional Greenhouse Gas Initiative.*

Analysis conducted by the University of New Hampshire Carbon Solutions New England program found that as of June 2012, projected cumulative energy savings due to GHGERF funded projects (\$21.8 million spent) are expected to be \$107.8 million through 2030 based on current energy prices. For every dollar spent as of June 2012, the projected expected return is \$4.95 in energy savings.

***New Hampshire Pay for Performance Program (N.H. P4P)***

Currently in its third year, the New Hampshire Pay for Performance (N.H. P4P) Program is funded through proceeds from the RGGI. N.H. P4P Program has met and surpassed the energy savings goals that were set forth when the program launched. N.H. P4P comprehensively addresses the energy efficiency needs of the commercial, industrial, and municipal government sectors by working with developers, building owners and their representatives to improve energy efficiency of commercial and industrial buildings. With funding from the GHGERF, TRC Energy Services designed and manages the N.H. P4P Program which has delivered comprehensive energy efficiency solutions to 47 commercial, industrial, and municipal facilities across the state, totaling more than \$12 million in construction (see map at <http://nhp4p.com/program-impact>). With a whole-building approach to energy savings, N.H. P4P estimates that it has saved more than 10.6 million kWh of electricity and 71,000 million BTUs of fossil fuels – resulting in projected GHG reductions of more than 10,886 metric tons. A project funded in the region was installation of heat pumps mat the Newton Memorial School.

**Renewable Portfolio Standard**

New Hampshire’s renewable portfolio standard (RPS), established in May 2007, requires the state’s electricity providers (with the exception of municipal utilities) to acquire by 2025 renewable energy sources (certificates or RECs) equivalent to 24.8 percent of their retail electricity sold to end-use customers.

**Eligible Renewable/Other Technologies:**

Solar Water Heat, Solar Space Heat, Solar Thermal Electric, Solar Thermal Process Heat, Photovoltaics, Landfill Gas, Wind, Biomass, Hydroelectric, Fuel Cells, Geothermal Heat Pumps, CHP/Cogeneration, Hydrogen, Anaerobic Digestion, Small Hydroelectric, Tidal Energy, Wave Energy, Ocean Thermal, Renewable Fuels, Biodiesel, Fuel Cells using Renewable Fuels, Micro-turbines



**Technology  
 Minimum:**

New Renewables (including thermal energy): 15% by 2025  
 New Solar-Electric: 0.3% by 2014  
 Existing Biomass: 8% by 2015  
 Existing Hydro: 1.5% by 2015

The RPS includes four standards for different types of energy resources requiring incremental increases for each type through 2025; these are classified as Class I New Renewable Energy, Class II New Solar, Class III Existing Biomass/Methane, and Class IV Existing Small Hydroelectric. The table below reports past data and future standards for each RPS Class.

*Table EE4. New Hampshire's Renewable Portfolio Standards by Class.*

Resource	2008	2009	2010	2011	2012	2013	2014	2015	2025
Class I	0.0%	0.5%	1.0%	2.0%	3.0%	4.0%	5.0%	6.0%	15.0%
Class II	0.0%	0.0%	0.04%	0.08%	0.15%	0.2%	0.3%	0.3%	0.3%
Class III	3.5%	4.5%	5.5%	6.5%	6.5%	6.5%	7%	8%	8%
Class IV	0.5%	1%	1%	1%	1%	1.3%	1.4%	1.5%	1.5%

The Public Utilities Commission (PUC) adjusts these rates annually by January 31 using the federal Consumer Price Index. The PUC is authorized to fine a supplier that violates RPS requirements, to revoke its registration, or to prevent it from doing business in the state.

The PUC must conduct a review of the RPS program and report of its findings to the legislature in 2011, 2018 and 2025, and include any recommendations for changes to the class requirements or other aspects of the RPS.

**NH Saves**

New Hampshire's regulated electric distribution utilities jointly develop and offer their customers energy efficiency programs under a statewide umbrella program, NH Saves. These programs are funded via a system benefits charge included in customer rates.

A **system benefit charge** is a charge on a consumer's bill from an electric distribution company that helps pay for the costs of certain public benefits program such as low-income assistance, energy efficiency programs, and public interest R&D efforts.

The mission of NH Saves is to advance the efficient use of energy, while caring for the environment and promoting economic development in New Hampshire. *NH Saves: Energy Efficient Products for Your Home and Business* is an annual publication offering state-of-the-art energy efficient lighting and products. The NH Saves website (<http://www.nhsaves.com>) offers tools, tips, design and purchasing information to help save money through efficiency.

**Local Energy Working Group**

The Local energy Working Group (LEWG) comprises many organizations and programs that collectively providing guidance, resources and coordination for New Hampshire's communities in addressing energy and climate change challenges. LEWG works in coordination and fiscal sponsorship from the New England Grassroots Environment Fund, through generous support from the N.H. Charitable Foundation.

The LEWG Mission and Purpose is to "Provide collaborative guidance and technical support to Local Energy Committees/Commissions (LEC's), municipalities, schools, and other political subdivisions seeking to reduce energy use, minimize energy costs, and/or reduce fossil-fuel consumption."

The LEWG strives to foster collaboration among public, private and non-profit entities to identify and support the development of the necessary resources and tools; interconnect community leaders to establish a network of local energy planners; and provide a clearinghouse to facilitate the communication of information and ideas.

LEWG provides resources including their annual Local Energy Solutions Conference, trainings and events and information about energy guides and reports, tools, and programs. See their website at <http://www.nhenergy.org/>. The LEWG is working toward the following energy-based outcomes.

*Short Term Outcomes: 1-3 years*

- The Local Energy Work Group will be the conduit for connecting energy committee members, and municipal and school staff/elected officials to each other throughout the state through peer-to-peer networking that is established and self-sustaining.
- An effective New Hampshire portal will be established to act as a clearinghouse of information on best practices, projects throughout the state, funding and technical assistance opportunities, and resources and guides that are available for LEC's, municipalities and schools to utilize.
- Teams with work plans that meet regularly and are well represented will be established to address the barriers in the following areas: Education, Outreach and Technical Assistance; Policy; and Financing.
- The Energy Work Group will annually identify the priority tools and resources needed by LEC's and municipalities to achieve significant reductions in energy use, cost or fossil fuel consumption.

*Medium Term Outcomes: 3-5 years*

- 50% of New Hampshire communities will possess increased knowledge and skill through the provision of ongoing outreach, education and technical assistance, which will enable them to take on increasingly sophisticated planning and project management efforts
- 25% of municipalities and schools integrate energy planning into all aspects of municipal facilities, vehicles and operations.

*Long Term Outcomes: 5+ years*

- Total community fossil-fuel-based energy consumption will be reduced 50% below 2005 levels by 2025

## State Building Code

According to the 2013 Department of Energy determination, energy cost savings for New Hampshire resulting from the state updating its commercial and residential building energy codes in accordance with federal law are significant, estimated to be on the order of nearly \$40 million annually by 2030.

Upgraded standards for State-owned or funded buildings were set per Executive Order 2011-1. New construction or renovations in excess of 25,000 square feet or \$1 million shall meet or exceed current Interagency Energy Efficiency Committee (IECC) energy code. Energy modeling is required to be conducted during the design process and third party commissioning is required in accordance with the recommendations of the IECC. Where practicable, all new construction projects shall include a renewable energy component in their design. The IECC code includes residential single-family housing and multifamily housing three stories or less above-grade intended for permanent living (hotels and motels are not "residential").



**Zone 6:** R-49 Ceilings, U-0.35 Windows and Doors, R-20 Walls, R-30 Floors, R-15 Foundations

**Zone 5:** R-38 Ceilings, U-0.35 Windows, and Doors, R-20 Walls, R-30 Floors

*Figure EE15. Primary building envelope requirements for Zones 5 and 6 ([http://quickfacts.census.gov/qfd/maps/new\\_hampshire\\_map.html](http://quickfacts.census.gov/qfd/maps/new_hampshire_map.html))*

The 2009 IECC code applies to new buildings and additions, alterations, renovations and repairs. The map below shows the location of Zone 6 and Zone 5 and the primary building envelope requirements for all residential buildings in each zone.

**New Hampshire Building Energy Code Compliance Roadmap**

The New Hampshire Building Energy Code Compliance Roadmap: Volume 1 Market Actor Identification and Barrier/Recommendations (GDS Associates, Inc. for NH Office of Energy and Planning, 2012) recommends a plan to reach the state’s goal of 90 percent compliance with the state energy code by the year 2017. This is an important goal because buildings use more energy and emit more carbon dioxide than either the industrial or transportation sectors. Residential and commercial development combined account for 52.5 percent of total energy consumption in the state.

**90% by 2017.** In response to the American Recovery and Reinvestment Act (ARRA), many state governors committed to reaching specific energy efficiency and conservation targets in their energy codes. Specifically, ARRA called for the development of plans to achieve 90% compliance with the 2009 International Energy Conservation Code for residential buildings and commercial buildings by the year 2017. Governor Lynch committed to these targets which qualified New Hampshire to receive \$25.8 million in ARRA – State Energy Program (SEP) stimulus funding.

The Volume I report concludes that with respect to energy codes [it appears] sufficient specific and enabling legislation, regulations, policies and guidelines exists for effective adoption and enforcement of appropriate energy codes and administrative requirements and responsibilities. However this is an overall lack of common understanding and implementation of these requirements/responsibilities within and across key organizations and stakeholder groups. Barriers to the ability to effectively enforce energy code compliance center around lack of resources (including funding, staffing and time) and the need to prioritize other responsibilities. (GDS Associates, Inc. for NH Office of Energy and Planning, 2012)

The report provides a detailed Navigation Plan which identifies key elements and indicators needed to reach the 2017 target (see page 7). Specific energy code “roadmaps” detail top energy code compliance barriers and high priority recommendations for various stakeholder groups called NH market actor groups (see pages 12-21).

KEY ELEMENTS	STAKEHOLDER GROUPS
<b>Strong Leadership and Policies</b>	Legislative, Policy and Regulatory Stakeholders Code Officials and Building Inspectors Building Professionals - Builders/Contractors Architects, Engineers, Designers Real Estate Professionals and Appraisers Lenders and Financing Organizations Commercial, Industrial Building Owners and Managers Homeowners, and the General Public Equipment Suppliers, Distributors, Manufacturers and “Hard to Reach” Communities
<b>Targeted outreach and Education</b>	
<b>Adequate Resources and Funding</b>	
<b>Verification and Enforcement</b>	
<b>Measurement and Evaluation</b>	

The New Hampshire Building Energy Code Compliance Roadmap Volume 2: Detailed Project Report provides an in-depth description of the nine (9) New Hampshire Building Code Compliance Program tasks, associated findings, and recommendations directly resulting from these activities. The nine New Hampshire Building Code Compliance Program Tasks are to”

1. Establish a baseline of energy code compliance in NH (both residential and commercial buildings), identifying roadblocks and solutions to improve compliance,

2. Create a roadmap to achieve 90% compliance with the NH state energy code (2009 IECC) by 2017,
3. Promote the program throughout the state to building and code professionals,
4. Train/mobilize building professionals for code compliance and promote above-code performance,
5. Develop a public awareness campaign for homeowners, landlords, commercial property owners, real estate professionals, and appraisers to understand the value of the energy code and above-code performance,
6. Update and gather building code resources in one publicly accessible site,
7. Develop recommended enforcement and compliance policy options for the 2009 IECC,
8. Establish a review process to monitor and track compliance under the 2009 IECC, and
9. Submit monthly reports to OEP to submit to the NH Office of Economic Stimulus, DOE, and the US Office of Management and Budget on data for number of jobs created/retained, trainings held, and people reached, and funding leveraged.

## Green Building

### Seacoast Area Renewable Energy Initiative

The Seacoast Area Renewable Energy Initiative (SEAREI) was formed in 2009 by members of the Piscataqua Sustainability Initiative (PSI) in partnership with Plymouth Area Renewable Energy Initiative. SEAREI is a not-for-profit organization working to build sustainable communities through energy efficiency, renewable energy and education in the Piscataqua region of New Hampshire and southern Maine. SEAREI is modeled after the traditional New England style "barn-raising" of neighbor helping neighbor. Homeowners and volunteers learn to install renewable energy systems and in turn help others with installations.

SEAREI accomplishes its mission by:

- Bringing down the cost of installing renewable energy systems
- Providing hands on education for the homeowner so they end up with a strong understanding of how their system works
- Developing a support network of knowledgeable families
- Providing local tradespeople an avenue to learn about installing renewable energy systems
- Building community connections while we all prepare for life in a lower energy world



Figure EE16. Solar panel installation on an outbuilding. [Photo: SEAREI <http://searei.org/seareis-photo-album/index.html>]

### N.H. Green Building Council

Organizations such as the Build Green N.H. Council and the N.H. Chapter of the U.S. Green Building Council (USGBC) promote and support transforming the built environment to one that supports a healthy community built on social responsibility, environmental stewardship and economic prosperity. N.H. USGBC offers a webinar series and case study presentations about innovative energy efficiency and green building projects.

The Build Green N.H. Council is comprised of industry professionals dedicated to providing green building guidelines for building and remodeling professionals and environmentally concerned consumers through its certification program.

The Build Green N.H. Council represents professional green builders and remodelers in New Hampshire by unifying the industry, promoting a broader understanding of green building, and increasing consumer

awareness of green building options. Build Green N.H. encourages builders and consumers to look to the National Green Building Standard for guidance. Houses that are designed or built to this standard include the following elements:

- Design of the Lot and Site
- Material, Resource Efficiency
- Energy Efficiency
- Recycled, Renewable, Reusable
- Water Efficiency
- Indoor Air Quality
- Education for Homeowners

**Green Building Facts**

The USGBC reports the following market impact statistics relating to green building and the economy.

Economy	Building Stock
By 2015, an estimated 40-48% of new nonresidential construction by value will be green, equating to a \$120-145 billion investment	More than 2.8 billion square feet of building space are LEED-certified (as of January 1, 2014)
The construction market accounts for 5.5% of the \$14.7 trillion U.S. GDP. This includes all commercial, residential, industrial and infrastructure construction	41% of all nonresidential building starts in 2012 were green, as compared to 2% of all nonresidential building starts in 2005
With energy efficiency financing having the potential to soar from \$20 to \$150 billion annually, over one million jobs could be created	<b><i>New Hampshire ranks among states with the greatest proportion of green office buildings relative to total stock of buildings in the market*</i></b>

*\* Among Washington D.C., Oregon, Vermont, Washington, Colorado, Massachusetts, Maine, Illinois, California [Source with references: <http://www.usgbc.org/articles/green-building-facts>]*

**Historic Preservation - Reuse Equals Reduce**

According to the report *The Greenest Building: Quantifying the Environmental Value of Building Reuse* ( The National Trust for Historic Preservation, 2011),\_the reuse and retrofit of existing buildings compared to new structures of equivalent size and functionality can, in most cases, meaningfully reduce the negative environmental impacts associated with construction of new buildings. The report’s key findings offer policy-makers, building owners, developers, architects and engineers compelling evidence of the merits of reusing existing buildings as opposed to tearing them down and building new. Those findings include:

- **Reuse.** Building reuse typically offers greater environmental savings than demolition and new construction. It can take between 10 to 80 years for a new energy efficient building to overcome, through efficient operations, the climate change impacts created by its construction. The study finds that the majority of building types in different climates will take between 20-30 years to compensate for the initial carbon impacts from construction.
- **Scale.** Collectively, building reuse and retrofits substantially reduce climate change impacts. Retrofitting, rather than demolishing and replacing, just one percent of the city of Portland’s office buildings and single family homes over the next ten years would help to meet 15 percent of their county’s total CO2 reduction targets over the next decade.
- **Design.** The environmental benefits of reuse are maximized by minimizing the input of new construction materials. Renovation projects that require many new materials can reduce or even negate the benefits of reuse.
- **The Bottom Line:** Reusing existing buildings is good for the economy, the community and the environment. At a time when our country’s foreclosure and unemployment rates remain high, communities would be wise to reinvest in their existing building stock. Historic rehabilitation has a

thirty-two year track record of creating 2 million jobs and generating \$90 billion in private investment. Studies show residential rehabilitation creates 50% more jobs than new construction.

The report is available at:

<http://www.preservationnation.org/information-center/sustainable-communities/green-lab/valuing-building-reuse.html>.

## Municipalities Support Renewable Energy

In the last 5 years, several municipalities have capitalized on grant opportunities to make their buildings and infrastructure more energy efficient, reduce harmful emissions, and save money. The efforts are highlighted below demonstrate a strong commitment in the region toward replacing fossil fuel based systems with local renewable energy sources.

### East Kingston Elementary School Solar Installation

The East Kingston Elementary school solar installation project was funded by a \$300,000 donation from the Richard E. Sargent Trust, a \$330,000 grant from the American Relief and Recovery Act, and \$30,000 from the school budget. The solar array located behind the school provides a 35 to 40 percent reduction in energy costs. Since the solar array came up in 2010, it has generated over 87,000 kilowatt-hours and has offset 109,000 pounds of CO<sub>2</sub>. The school also boasts a new high-efficiency boiler and an extensive recycling program.

### Exeter Department of Public Works Solar Array

A solar photovoltaic array was installed at the Town of Exeter's waste water treatment plant (WWTP) in 2012. The ground mounted 50-kilowatt array, located on the Department of Public Works campus, will produce up to 5 percent of the plant's electricity, resulting in an estimated savings of \$31,000 over 10 years. The project was carried out through a combination of state and federal funding - a \$100,000 grant from the Energy Efficiency and Conservation Block Grant (EECBG) helped offset the upfront installation costs for the town.

To put carbon dioxide emissions into perspective, about one metric ton of carbon dioxide (CO<sub>2</sub>) is produced to meet the average monthly energy demand of the typical American household.

### Exeter Area High School Solar Array

The solar array at Exeter Area High School — which generates 100 kilowatt hours of energy and offsets about 5 percent of Exeter High School's energy needs — has been producing energy since September 2010. Combined the solar array and new high efficiency natural gas boilers save the school district about \$200,000 per year. The 465 solar panels located at the entrance to the school are the result of a partnership between Revolution Energy (a scalable renewable energy solutions company) and four other entities who call themselves the New England Seacoast Energy Partnership as well installation help from 55 students from the Seacoast School of Technology. The system will offset 57.5 metric tons of carbon dioxide annually.

### Hampton Falls co-generation installation at the Police/Fire Station

With a \$78,000 grant from the N.H. Office of Energy and Planning, New Hampshire's Energy Efficiency and Conservation Block Grant Program, the Town of Hampton Falls replaced a very inefficient oil fired furnace with a new high efficiency cogeneration unit for building heat and solar thermal panels for hot water. Combined heat and power (CHP), also known as cogeneration, is an efficient, clean, and reliable approach to generating power and thermal energy from a single fuel source and has both economic and environmental benefits. The installation produces 21,000 kWhs (equivalent to 2 to 3 homes) of electricity annually, while recovering 191 MMBTU's (equivalent to 1,400 gallons of fuel oil) of heating energy annually and has an estimated payback period of approximately 7 to 10 years based on yearly energy savings of \$8,127.

### North Hampton Residential Solar Installation

A private developer in partnership with a New Hampshire based solar installation company, are currently in the permitting phase to construct a community Solar Garden. A community Solar Garden is a solar PV array

that is built at one location, also known as a “host”, and the value of the power is shared with participants, also known as a “group member”. The installation will be a group net metering whereby the energy generated will be distributed to two existing homes (though the system can support 4 additional homes) and any unused electricity will be sold back to the PSNH distribution grid and other PSNH customers can join this “group” to take advantage of a reduced energy rate.

## Local Actions to Expand Energy Choices and Efficiency Standards

### **Hampton Residents Work with Unitil to Extend Natural Gas Service to a Residential Neighborhood**

By Sunny and Barbara Kravitz, Hampton Residents

We live in a neighborhood of 62 homes in Hampton built during the 1980’s when oil was inexpensive. Because oil prices began changing hourly, I decided to try to bring natural gas to the homes in my neighborhood. In 2013 I decided to take a petition around and 47 homes signed saying they would convert to natural gas if Unitil (Northern Utilities) would make it available. I spoke with Janet Oliver, Business Development at Unitil, and gave her the petition. In 2014 Unitil responded with an offer: if 31 homes would sign a contract to install a natural gas boiler, and agree to share in the infrastructure installation cost at \$1,800 dollars per household, payable at 0% over 5 years on our utility bill (\$30 dollars a month), Unitil would agree to construct the gas line. Unitil estimated the project would cost about \$600,000 and it would be the first time Unitil would install a gas line in an existing residential area. They normally work on new construction where the developer picks up the installation costs. By the time we got the 31 signed contracts it was early fall and too late to start the installation.

Last spring Unitil asked the 31 homes to sign a new contract with the same terms. A few of the homes had changed hands and only 29 homes signed the contract. Installation was completed by October 2014. Representatives of Unitil have said that they would like to replicate this model to expand the use of natural gas for home heating.

### **Town of Epping Adopts an Energy Efficiency Ordinance**

#### *Article 22 Energy Efficiency and Sustainable Design (ICLEI)*

Motivated by participation in the New Hampshire Carbon Coalition’s Climate Change resolution, Epping set a goal to reduce their greenhouse gas emissions by 25 percent by the year 2025. The Town Planning Board agreed to participate in reaching this commitment by drafting a new ordinance that would require all new buildings to implement energy efficiency, conservation and sustainable design principles in its construction. Called Article 22 Energy Efficiency and Sustainable Design, the ordinance was placed on the Town Warrant in March 2007 and passed 700-606.

Article 22 is designed similarly to LEED certification with points being awarded based on number and types of energy efficiencies and encourages the use of on-site renewable energy. The ordinance applies a graduated compliance system meaning that the square footage of the building dictates number of minimum points required and therefore, the larger the building, the more points are required. This was included to address the concerns of small business owners. Regardless of the size of the new building or development, each structure must meet requirements for energy production and/or sustainable design.

#### **Community Outreach**

The Town Planner and Planning Board spent several months educating the community about the ordinance by engaging involve community residents and business owners in a series of public meetings held once a month for three months. Existing buildings were used as examples of how sustainable design and energy efficiency in buildings was already happening, and saved money. The Board created a website to provide detailed

information including links to presentations, photographs of existing buildings, and data on projected cost savings and greenhouse gas emissions reductions.

#### Leading by Example

Epping Town Hall has lead by example by completing a variety of energy retrofits, including a 4 kWh combined heat and power system, the first one at a town hall in the country. Epping also retrofitted the windows and insulation and installed a 1 kWh solar array which reduced their electricity bill 50 percent and heating costs by 50 to 60 percent. The School Department replaced their windows and has saved approximately 15 percent in energy savings, while the Library replaced their oil boiler with a modulating propane boiler, achieving significant energy savings.



## Key Issues and Challenges

### Key Energy Issues

**Energy is not valued in ways that promote efficiency and choice of renewable sources.**

For the time being, the convenience and relative stability of gas and fuel oil prices coupled with public ambivalence toward social, environmental and health impacts of fossil based fuel use dampen choices toward renewable and alternatives energy sources. By embracing a diverse and interconnected set of energy solutions, these systems promote the self-reliance of both individual communities and New Hampshire as a whole. The options for power generation, transportation, industry and building function are enhanced by a boom in home-grown clean energy from New Hampshire - keeping dollars in state and reducing pollution.

**Energy security and renewable energy are important for our economy and quality of life.**

Most of New Hampshire's energy is imported from outside New England and outside the U.S. The N.H. Climate Action Plan recommends expanding the capacity of renewable energy sources to reduce the dependence on imported fossil fuel and retain more energy dollars in New Hampshire, which also has a positive impact on non-energy sectors of the state economy.

As reported in the State Energy Strategy (draft, 2014), the combination of reduced demand and further development of diverse renewable power generation assets helps New Hampshire achieve its renewable portfolio standard target level. The Renewable Portfolio Standard program requires electric suppliers to procure an increasing percentage of their supply from renewable energy up to 23.8% by 2025. Currently, 7.2 percent of the energy New Hampshire produces in-state comes from renewable sources. How does renewable energy benefit New Hampshire? Renewable energy helps to:

- Decrease our dependence on imported oil
- Enhance national security
- Diversify the state's energy supply
- Stabilize and reduce energy prices
- Boost the state's economy by creating new jobs and industries
- Keep more energy dollars in the state's economy
- Reduce harmful emissions from all sources to improve air quality

Renewable energy production, especially on a smaller scale, will help meet New Hampshire's energy goals and consumer needs while increasing resiliency of distributions systems and markets and energy independence. Localized energy systems provide a measure of surety against grid outages and other supply disruptions by allowing customers and the distribution system to utilize various fuels and stored power as needed. Relying on renewable resources will foster self-sufficiency within communities across the state particularly during weather related events that damage distribution systems.

**Most energy sources used in New Hampshire are carbon based.**

The N.H. Climate Action Plan recommends increasing energy production from renewable and low-CO2-emitting sources of energy in a long-term sustainable manner. By understanding the role of energy use all consumers are in a position to address both energy choices and climate change simultaneously. As shown in Figure EE7, total energy production in the state is derived from 89 percent non-renewable sources and 11 percent renewable sources. Reliance on imported energy sources means consumers are subject to instability of energy markets and their purchasing dollars leave the regional and states economy.

**Energy efficiency and conservation are necessary to moderate use of non-renewable energy sources.**

The three primary means to address the use of energy are energy conservation, energy efficiency and use of renewable energy. Energy conservation is the most cost effective means to reduce the import of energy into the state, reduce greenhouse gas emissions and reduce energy costs as it involves the avoidance of energy use.

Efficiency entails is using less energy to accomplish the same amount of work. This can include lighting efficiency, where advanced lighting can be installed that provides the same or higher quality light at a fraction of the energy consumption of the old lighting. It also includes production efficiency where machinery, fixtures and processes within facilities can be improved to reduce the amount of energy consumed to produce goods.

Energy efficiency and conservation focuses on one main objective - reducing overall energy consumption across all sectors thus reducing energy costs and environmental pollutants. Communities can achieve reductions in energy consumption by taking these steps:

- Efficiency for both existing and new buildings, infrastructure and vehicles
- Community awareness and participation
- Transportation system choices and alternatives for transit and non-motorized travel
- Access to clean, renewable and alternative energy choices
- Recycling, composting and reuse programs
- Consumerism of local products and services
- Education and assistance programs

## Energy Challenges

Managing the state’s energy future and enacting solutions will require state, regional, municipal and consumer participation. The challenge therefore is effective implementation at all scales and across multiple sectors.

Energy is fundamentally linked to climate change and mitigating its impact by controlling the levels of greenhouse gases in the atmosphere, CO<sup>2</sup> being the largest component. Mitigation can be implemented in many ways including energy efficiency and conservation, use of renewable and low CO<sup>2</sup> emitting energy sources, and protecting the resources that capture and store CO<sup>2</sup> such as forests and other vegetation. Climate change certainly is a challenge but one that offers opportunities with respect to energy. Many recommendations in the State Climate Action Plan and State Energy Strategy (2014) call for changes that also benefit our economy, environment and quality of life. Enhancing these benefits can only provide positive results that make our state more resilient and competitive.

**Electric Vehicle Charging Station Opens at Redhook Brewery in Portsmouth**  
On September 16, 2014, a publically-available electric vehicle charging station was opened at the Redhook Brewery at the Pease International Tradeport. Redhook Brewery in partnership with and funding support from Public Service of New Hampshire (PSNH) has purchased Renewable Energy Credits to offset the electricity used by the station.

### Implementation of State Strategies and Plans

In terms of implementation, the state has several policies already enacted to help address energy consumption and GHG emissions (RGGI and RPS) but lacks dedicated funding to advance strategies and recommendations in the N.H. Climate Action Plan and State Energy Strategy (2014).

Table EE5. Comparison of energy strategies and recommendations from the N.H. Climate Action Plan and State Energy Strategy (2014).

Strategy	Energy Efficiency	Emissions Reductions	Fuel Choice and Availability; Renewable Power Use/Generation	Transportation Options
<b>N.H. Climate Action Plan (2009)</b>	Maximize energy efficiency in buildings.  Lead by example in government operations.	Protect natural resources (land, water and wildlife) to maintain the amount of carbon fixed or sequestered.  Reduce vehicle emissions through state actions.	Increase renewable and low CO <sub>2</sub> -emitting sources of energy in a long-term sustainable manner.	Encourage appropriate land use patterns that reduce VMT.  Reduce VMT through an integrated multi-modal transportation system.
	Other: Plan for how to address existing and potential climate change impacts. Develop an integrated education, outreach and workforce training program.			
<b>N.H. State Energy Strategy (2014)</b>	Finance infrastructure and building efficiency with state programs  Efficiency through state standards and codes  Controlling costs through alternative rates and pricing	<i>Applicable to all strategies</i>	Fuel Choice: primarily in-state renewable and alternative sources  Renewable: residential and commercial solar PV  Utility scale PV  Biomass, wind, hydroelectric and offshore wind	Fuel economy Electric and natural gas vehicles  Mass transit options  Smart growth strategies to reduce VMT and efficiency  Pricing programs to reduce VMT
	Other: Grid Modernization			

The N.H. Climate Action Plan and N.H. State Energy Strategy (2014) contain strategies to address energy efficiency, emissions reductions, fuel choice and availability, grid improvements and management, renewable power use and generation and transportation options. While both Plans focus on state and local implementation, the N.H. State Energy Plan (draft) relies more on state programs and standards, pricing and efficiency.

### Grid Modernization

The N.H. State Energy Strategy (2014) describes a vision for electric grid modernization that could provide multiple benefits to New Hampshire consumers and meet several strategies outlined in the Plan. Grid modernization would provide the platform upon which to effectively manage energy sources, demand, supply and efficiency state-wide. Grid modernization refers to ensuring that the electric grid is more resilient and flexible, has adequate storage capacity, able to integrate intermittent energy sources (such as energy produced through net metering), and able to provide real-time information to help customers manage their energy use. The potential benefits of grid modernization can include: better outage response and increased reliability; customer engagement in reducing peak demand; improved integration of distributed generation, renewable resources and storage; improved efficiencies for distribution utilities; integration of electric vehicles; and cost savings for all customers.

Once modernized, distribution grid efficiency will rely on consumer behavior to manage demand and availability. Consumer behavior programs (residential and small users) and demand response programs (large users) are voluntary programs that create energy savings and shift energy use away from peak periods when energy is most expensive by engaging and incenting consumers. New Hampshire utilities have piloted several

such programs focused on increased efficiency as a means to reduce peak load (total demand on the system). Peak load reduction is important to lowering the overall costs for all customers of the regional electric system. In the absence of peak load management, the grid must be sized to serve the highest peak minute of the year, even though the majority of the year the load is considerably lower. This 'oversizing' of the system creates considerable costs for ratepayers, so any reductions in the peak mean real savings for all customers.

**Local Energy Committees**

Many municipalities in the region have well-established energy committees that have advanced energy considerations and planning in their communities. Actions include Master Plan Energy Chapters, municipal energy inventories, and facilities audits, zoning and land use regulation changes, and public outreach and education. For most municipalities, energy related activities are led by a local energy committee with support from municipal staff, elected officials, planning boards and conservation commissions.

The technology, equipment, and techniques to drastically reduce municipal energy use and expand renewable and alternative sources are now readily available for buildings, infrastructure, street lighting and transportation. By reviewing all investments and decisions for energy efficiency and sustainability, municipalities can not only reduce their operating expenses and energy consumption, and lower their emissions, but it can also set an example for residents and business owners to follow.

Successful intra-municipal collaboration relies on a well-organized and informed local energy committee with strong support by the town.

Voluntary intra-municipal collaboration will be an important component of local implementation of energy actions and strategies, in addition to those required or enabled by federal and state standards and programs. Successful intra-municipal collaboration relies on a well-organized and informed local energy committee with strong support by the town.

**Environment**

Applying strategies that mitigate the impacts of climate change are recommended in the state's Climate Action Plan. Many strategies require coordinated on at all levels – federal, state, regional municipal and non-governmental – and focus on:

- Reduction of greenhouse gas emissions.
- Protection of land that provides carbon storage.
- Replacement of fossil fuel based energy sources with renewable and low emissions sources.

*Figure EE17. Type and extent of projected change to natural systems resulting from climate change. (Wake, et al., 2011)*

**How could projected changes in climate affect the places where we live, work, and play?**

Seacoast community members provided the following responses to this question during a recent workshop on the past, present, and future climate of coastal New Hampshire.

**Their ideas fell into three major categories:**

**OUR COMMUNITIES**

- Reduced heating and increased cooling costs
- Greater stress on routine and emergency services
- Expansion in diseases from ticks and mosquitos
- Increased summer heat resulting in discomfort and heat stroke
- Increased ozone pollution
- Changes in tourism economy
- Property loss leading to tax revenue loss
- Impacts on coastal historical resources and culture
- Increased need for community preparedness and planning
- Increased stress on the most vulnerable populations

**OUR NATURAL PLACES**

- Species loss and change
- Increased invasive species and insects
- Changes in agriculture, such as longer growing seasons and increases in weeds and pests
- Changes to rivers and aquatic habitats
- Changes in migration and ecological patterns
- Loss of pollinators
- Changes in wildlife habitat
- Forest impacts, such as loss of maple syrup and change in tree species

**OUR WATER**

- Changes to seasonal recreation
- Greater flooding
- Damages to infrastructure
- Risks to drinking water supply
- Greater drought and fire risk
- Changes in groundwater flow to wetlands and rivers
- Less frozen conditions resulting in greater groundwater recharge



Figure EE17, from a summary of the report *Climate Change in the Piscataqua/Great Bay Region: Past, Present, and Future* (Wake, et al., 2011) describes the type and extent of projected change to natural systems resulting from climate change, largely driven by energy consumption and choices. Alterations to our region’s climate could result in changes or decline in certain natural systems on which we rely for services and economic value, recreation, flood protection and quality of life.

**Public Health**

The increasing trend of pollutants and harmful emissions to our atmosphere in recent decades has caused concern over its effect on public health, environmental ecosystems and climate worldwide. Concentrations of a number of pollutants, byproducts of the burning of fossil fuels, have increased rapidly in the atmosphere as consumption of fossil based fuels has also increased. However, the long-term effects of air pollution on public health are largely unknown in New Hampshire.

Refer to the Climate Change Chapter for additional information about the health effects of emissions.

**Planning Our Energy Future**

**Incorporating Energy in Existing Planning Processes and Tools**

Many communities have discovered that traditional approaches to planning and development are creating, rather than solving, societal and environmental problems. Where traditional approaches can lead to congestion, sprawl, pollution and resource overconsumption, sustainable growth development offers real, lasting solutions that will strengthen communities in the future. Applying principles of sustainability can address many of these impacts and negative consequences.

Sustainability is based on the principle that everything we need for our survival and well-being depends, either directly or indirectly, on our natural environment. Sustainability creates and maintains the conditions that permit fulfilling the social, economic and other requirements of present and future generations.

Sustainability principles cut across most sectors of daily life: environmental, economic and societal. Ecologists recognize that there may be limits to sustainable growth and offer the alternative of a “steady state economy” in order to address environmental concerns such as resource consumption, energy production, and land conservation.

*Table EE6. Integrating Energy Planning with Community Planning*

<b>Energy Conservation Measures</b>	<ul style="list-style-type: none"> <li>▪ Energy efficiency in buildings, fixtures and infrastructure.</li> <li>▪ Behavioral changes including trip consolidation, ride sharing, lighting and appliance use, efficient equipment and other products, and recycling and composting (minimize post-consumer waste)</li> </ul>
<b>Sustainability</b>	<ul style="list-style-type: none"> <li>▪ Incorporate a mix of uses to provide a variety of housing, employment, shopping, services, and social opportunities for all members of the community.</li> <li>▪ Preserve working landscape by sustaining farm and forest land and other rural resource lands to maintain contiguous tracts of open land and minimize land use conflicts.</li> <li>▪ Provide choices and safety in transportation to create livable, walkable communities that increase accessibility for people of all ages, whether on foot, bicycle, or in motor vehicles.</li> <li>▪ Protect environmental quality by minimizing impacts from human activities and planning for and maintaining natural areas that contribute to the health and quality of life of communities.</li> <li>▪ Involve the community in planning and implementation to ensure that development retains and enhances the sense of place, traditions, goals, and values of the community.</li> <li>▪ Manage growth respecting the local community tradition, but work</li> </ul>

	<ul style="list-style-type: none"> <li>with neighboring towns to achieve common goals and address common problems more effectively. <ul style="list-style-type: none"> <li>▪ Protect human health and safety</li> </ul> </li> </ul>
<b>Alternative Transportation</b>	<ul style="list-style-type: none"> <li>▪ Public transit infrastructure including access, convenience, and competitive pricing</li> <li>▪ Voluntary actions such as carpools, rideshare programs, and park and ride facilities</li> <li>▪ Accommodations for bicycles and pedestrians.</li> </ul>
<b>Local Production and Services</b>	<ul style="list-style-type: none"> <li>▪ Support agriculture and local businesses</li> <li>▪ Buying local supports the community and state economy</li> <li>▪ Ensures self-sustaining practices and security</li> </ul>

Planning for sustainability promotes responsible development and includes the following processes, practices, and outcomes. (American Planning Association, 2000)

**Process**

- Making planning decisions in a holistic and fully-informed manner that involves all segments of the community and the public and private sectors.
- Educating all age groups to raise public understanding of and regard for the future consequences of past and current planning decisions and ultimately change human behavior.

**Practice**

- Developing a future-oriented vision, looking beyond current needs and recognizes environmental limits to human development.
- Advancing projects and activities that promote economic development that: efficiently and equitably distribute resources, services and goods; minimize, reuse and recycle waste; and protect natural resources.
- Foster a widely accepted ethic of stewardship that strongly encourages individuals and organizations to take full responsibility for the economic, environmental, and social consequences of actions, and balances individual needs with environment and public welfare.
- Take leadership in implementation of local, regional and state policies and engage in inter-municipal and regional initiatives that support sustainability.

**Outcomes**

- Local and regional development patterns that expand choice and opportunity for all persons.
- Resilient, diverse, and self-sufficient local economies that meet the needs of residents and build on the unique characteristics of the community whenever possible.
- Communities with a healthy environment and social climate that function in balance with natural ecosystems and allow individuals to lead healthy, productive and enjoyable lives.

## Energy Recommendations and Implementation

### Recommendation 1

**Regional strategies for transportation, land use and environment improve energy efficiency, increase renewable energy production and decrease emissions.**

#### Actions

- Incorporate cross-cutting energy issues and recommendations from the Transportation, Land Use and Environment Chapters of the Regional Master Plan in RPC's Long Range Transportation Plan.
- Work with regional stakeholders and municipalities to align existing and future funding sources to implement cross-cutting energy issues and recommendations from the Regional Master Plan.

### Recommendation 2

**Evaluate and develop recommendations, in collaboration with the N.H. Coastal Adaptation Workgroup, to incorporate energy planning (sources, availability, efficiency and cost) as a climate change adaptation strategy.**

#### Actions

- Evaluate ways municipal zoning, land development regulations and plans might incorporate standards that result in reduction of greenhouse gas emissions.
- Identify measures that incorporate energy efficiency and renewable energy sources when retrofitting buildings and infrastructure for purposes of adaptation and resiliency.
- Collaborate with state agencies to identify policies and standards to reduce greenhouse gas emissions and vehicles miles travelled, protect lands that provide carbon storage, retrofit buildings and facilities, and improve access to public transportation options in the region.

### Recommendation 3

**Provide guidance and technical assistance to municipalities to implement energy conservation measures in municipal investments, policies and plans.**

#### Actions

- Apply successful strategies and actions from the Energy Technical Assistance Partnership (ETAP) program to municipal investments, policies and plans.
- Inform municipalities of federal, state, and non-profit programs to fund energy retrofits and installations for buildings and infrastructure, and development of long range policy and planning actions.
- Coordinate with utility companies to provide information to municipalities, residents and businesses on cost-saving and energy efficiency measures.
- Prepare Energy Chapters for local Master Plans.

### Recommendation 4

**Municipalities enable installation of renewable energy sources through zoning, land development regulations and plans.**

#### Actions

- Engage residents and businesses in discussions about the benefits of renewable energy sources, and challenges in managing their buildings and infrastructure.
- Complete an audit of zoning, land development regulations and plans to identify barriers and create incentives for development of local renewable energy sources.

## Recommendation 5

**Support municipalities to adopt zoning and land use regulations requiring site design and construction methods that maximize energy efficiency in homes, buildings and infrastructure.**

### Actions

- Engage residents and businesses in discussions about energy efficiency and conservation options, cost and availability of energy sources, and challenges in managing their buildings and infrastructure.
- Inform municipalities of energy efficiency standards and energy incentives applied successfully in zoning and land use regulations at the local level.
- Facilitate collaboration between municipalities and the site design, construction, and renewable energy sectors.

## Recommendation 6

**Implement recommendations relating to energy from the State Climate Action Plan and N.H. State Energy Strategy (2014).**

### Actions

- Collaborate with state, regional and non-profit practitioners to implement recommendations that meet goals of the State Climate Action Plan and N.H. State Energy Strategy (2104).
- Implement recommendations from the Regional Master Plan that meet goals of the State Climate Action Plan and N.H. State Energy Strategy (2014).
- Incorporate goals from the State Energy Strategy in RPC’s Long Range Transportation Plan.

## Energy Goals and Recommendations Matrix

	EN Goal 1	EN Goal 2	EN Goal 3	EN Goal 4	EN Goal 5	EN Goal 6	EN Goal 7
<b>Recommendation 1</b>	S	P	P	S	P	S	TBD
<b>Recommendation 2</b>	P	TBD	S	P	P	S	S
<b>Recommendation 3</b>	S	P	S	P	S	P	TBD
<b>Recommendation 4</b>	S	P	P	S	S	P	TBD
<b>Recommendation 5</b>	P	S	S	P	S	P	TBD
<b>Recommendation 6</b>	S	S	S	S	S	S	S
S = Energy Recommendation significantly supports the Energy Goal. P = Energy Recommendation partially supports the Energy Goal. TBD = to be determined N/A= not applicable							

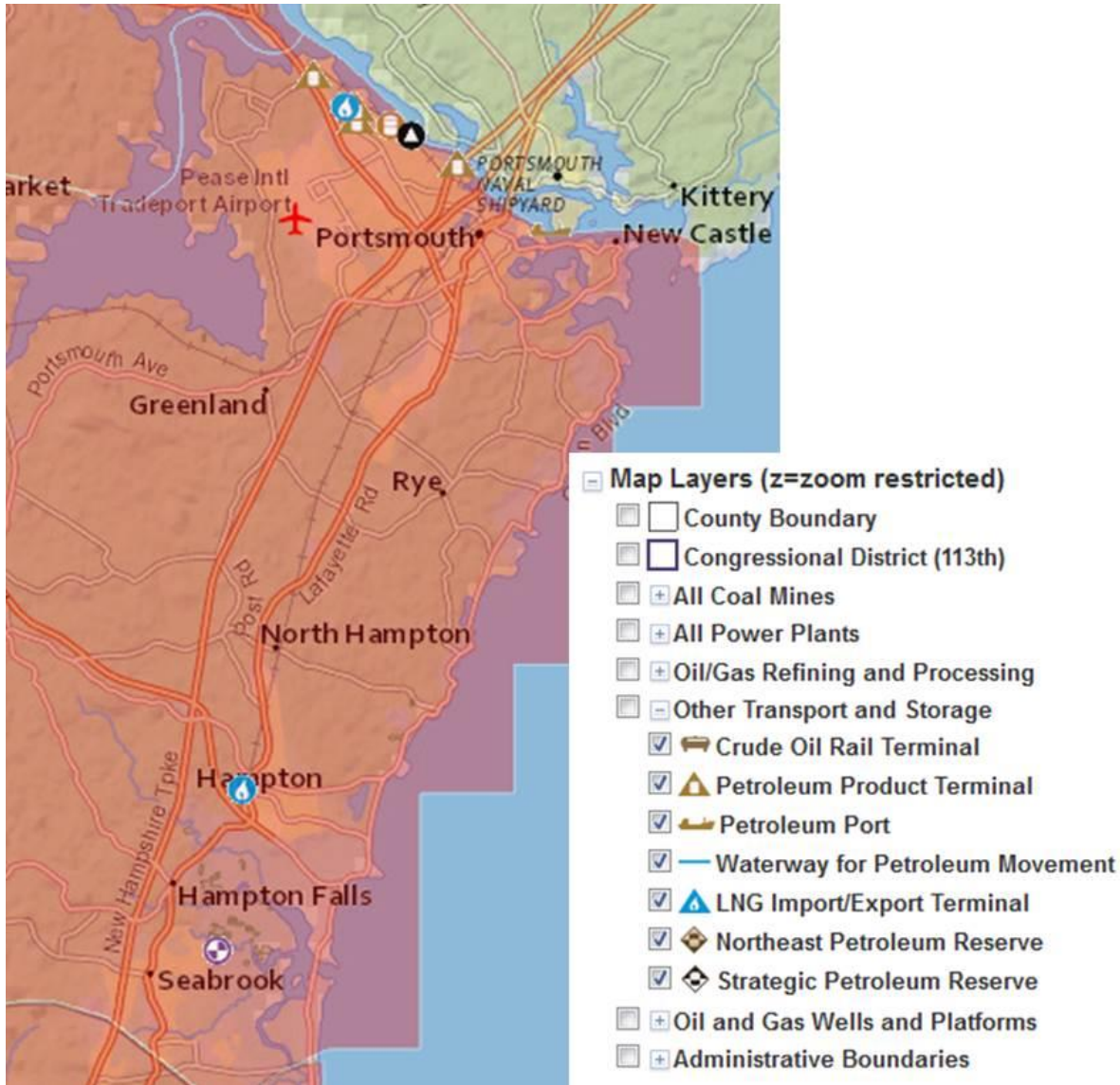


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## Appendices

### Appendix A Map EE1. Energy facilities and infrastructure in seacoast New Hampshire.



[Source: U.S. Energy Information Administration at <http://www.eia.gov/special/floodhazard/>]

**Appendix B Map EE2. Location of electric and gas distribution lines.**

Map EE2 is attached on the following page.